Imperial Bureau of Plant Breeding and Genetics

Plant Breeding Abstracts

Vol. VIII, No. 4.

School of Agriculture
Cambridge
England

1st July, 1938

TABLE OF CONTENTS.

		PAGE
519	Statistics* (Empire)	311
	(Foreign)	331
575	Breeding* (Empire)	311
	(Foreign)	331
575.1	Genetics* (Empire)	312
	(Foreign)	334
576.16	Origin of Species, etc.	338
576.3	Cytology* (Empire)	312
	(Foreign)	338
58	Botany*	339
631.421	Field Tests (Empire)	312
	(Foreign)	340
632	Plant Diseases* (Empire)	315
	(Foreign)	341
633	Economic Plants	342
633.1	Cereals	344
633.11	Wheat (Empire)	316
	(Foreign)	344
633.13	Oats (Empire)	318
	(Foreign)	356
633.14	Rye	359
633.15	Maize	359
633.16	Barley	361
633.17	Millets and Sorghums (Empire)	318
	(Foreign)	363
633.18	Rice (Empire)	318
	(Foreign)	364
633.2	Herbaceous Forage Plants	365
633.3	Leguminous Forage Plants (Empire)	319
	(Foreign)	368
633.4	Roots and Tubers (Empire)	320
	(Foreign)	371
633.5	Fibres (Empire)	321
	(Foreign)	375
633.6	Sugar Plants (Empire)	325
	(Foreign)	378
633.7	Stimulants (Empire)	327
	(Foreign)	382
633.8	Aromatic Plants	328
633.85	Oil Plants (Empire)	328
	(Foreign)	392
633.91	Rubber Plants	393
634	Fruit Trees (Empire)	329
	(Foreign)	395
634.3	Citrus Fruits	400
634.5	Nuts (Empire)	329
	(Foreign)	401
634.6	Palmaceous and Other Fruits	402
634.7	Small Bush Fruits	403
634.8	Viticulture	403
634.9	Forestry	407
635	Vegetables (Empire)	329
	(Foreign)	409
	Book Reviews	416
	New Journal	425

Note.—Initialled abstracts are written by the following:—

Mr T. C. Chin	T. C. C.
Mr H. O. Hartley	H. O. H.
Dr B. P. Pal	B. P. P.
Mr M. Pill	M. P.
Mr J. Sinisalo	J. S.
Dr J. Wishart	J. W.

* General studies, see also individual crops.

Plant Breeding Abstracts.

Vol. VIII, No. 4.

Part 1. Empire Section

STATISTICS 519

999. PITMAN, E. J. G. 519.24
Significance tests which may be applied to samples from any populations. III. The analysis of variance test.
Biometrika 1938 : **29** : 322–35.

The form of the analysis of variance test which involves no assumptions of normality, as in the customary test, is discussed. Expressions for the first four moments of the statistic used in this test (equivalent to Fisher's z) are obtained. From these it appears that when the number of individuals in each batch (or block), and the numbers of batches are both not too small, the usual test may be safely applied. A method of testing the validity of the approximation which this test employs is stated, and modifications of procedure, when necessary, are suggested. The subject matter of the paper is confined to the test arising from problems of the "randomized block" variety. J. W.

1000. WELCH, B. L. 519.24
The significance of the difference between two means when the population variances are unequal.
Biometrika 1938 : **29** : 350–62.

Three tests of the hypothesis that the means of two normal populations are equal are considered, the object being to study how closely each of these controls the risk of rejecting the hypothesis when it is actually true. None of the tests was exact in the sense that it would control this risk precisely, whatever the unknown ratio θ of the variances of the two populations.
The first criterion u, which is the best criterion when it is known that θ is unity, being in fact the commonly used t-test, can under certain circumstances be seriously biased when θ differs from unity. The second criterion v, which employs separate estimates of the unknown variances, as in the old large sample test, is very much less liable to bias. Unless it is definitely known that $\theta = 1$, the general use of v rather than u is recommended. The third test, put forward from considerations of judicial probability, has not been considered in detail in relation to the question of bias, and in the author's view is open to criticism. J. W.

BREEDING 575

1001. BELL, G. D. H. 575:633
Some aspects of the influence of scientific research on plant breeding.
Rep. & J. Wom. Fm. Gdn. Ass. 1938 : 39–43.

A brief account for women farmers and gardeners of the application of genetical and cytological research to plant breeding, with the emphasis on the limitations.

1002. BELL, G. D. H. 575:633(48.5)
Report of a visit to certain Swedish Plant Breeding Stations. August, 1937.
Pl. Breed. Inst. Cambridge 1937 : Pp. 12. (Mimeographed.)

Brief accounts are given of the breeding work on wheat, oats, barley, grasses, clovers and root crops at Svalöf, on sugar beet at Hilleshög and on wheat, oats and pasture plants at Landskrona. Swedish and British plant breeding are compared and the value of such visits is stressed.

1003. 575:633(94.6)

The Departmental Research Farm.

Tasm. J. Agric. 1938 : **9** : 1–4.

One of the activities of the new Departmental Farm near Cressey, where work has been in progress since last March, is plant breeding. Selected lines of wheat, oats and peas are undergoing advanced trials and many lines of hybrid wheats are under observation.

1004. 575:633:061.3

Empire Exhibition (Scotland), 1938.

Scot. J. Agric. 1938 : **21** : 185–87.

Exhibits illustrating plant breeding work with potatoes, flax and oats will be shewn at the Empire Exhibition at Glasgow, in the Agriculture, Fisheries and Forestry Pavilion.

1005. Lawrence, W. J. C. 575:633:575.1

Plant improvement: the application of genetics to horticulture.

Bull. Fac. Agric. Hort. Univ. Reading 1938 : **50**. Also Sci. Hort. 1938 : **6** : 117–23.

The value of a knowledge of genetics to the plant breeder is indicated in general terms.

GENETICS 575.1

1006. Scott-Moncrieff, R. 575.11.061.6:581.192:581.46

The nature and inheritance of flower colour.

Bull. Fac. Agric. Hort. Univ. Reading 1938 : **50**. Also Sci. Hort. 1938 : **6** : 124–32.

A fuller account of this will be found in the same author's article reviewed in "Plant Breeding Abstracts", Vol. VI, Abst. 1057.

CYTOLOGY 576.3

1007. Sansome, F. W. 576.312

Chromosomes and their importance in horticulture.

Sci. Hort. 1938 : **6** : 199–214.

The behaviour of chromosomes in diploids and polyploids is described and its genetical and plant breeding significance is indicated.

1008. Patel, J. S. and Narayana, G. V. 576.312.35

Chromosome numbers in some economic flowering plants.

Curr. Sci. 1938 : **6** : 509–10.

The following somatic numbers are recorded: *Arachis hypogaea*, 40, *Moringa oleifera* Lam. 28 + 2 fragments, *Coriandrum sativum* L., 22 and *Vetiveria zizanoides* Nash, 30.

1009. Blakeslee, A. F. 576.356.5:581.04

Doubling chromosomes by means of colchicine.

Gdnrs' Chron. 1938 : **103** : Ser. 3 : 270–71.

A circularized letter giving practical instructions for the use of colchicine in inducing chromosome doubling.

FIELD TESTS 631.421

1010. Goulden, C. H. 631.421

Modern methods for testing a large number of varieties.

Publ. 575 Dep. Agric. Dom. Canada 1937 : Tech. Bull. 9 : Pp. 36.

This is a very readable account of those modern methods of Pseudo-Factorial and Incomplete Randomized Block experiments that are especially suitable for the testing of a large number of varieties together. The methods are due to Yates, and the opinion is expressed that they should receive the serious consideration of all agronomists concerned with varietal trials, who could not have a better exposition than that provided here. Fully worked out examples of the

methods are included to give practice in computation. The new methods are shewn to have an increased efficiency over the older methods, and to have the advantage of adaptability to irregularly-shaped areas. J. W.

1011. SMITH, H. F. 631.421
An empirical law describing heterogeneity in the yields of agricultural crops.
J. Agric. Sci. 1938 : **28** : 1–23.

The author finds from data of a "blank" experiment with wheat that the regression of the logarithms of the variances for plots of different areas on the logarithms of their areas is approximately linear. Thirty-nine other experiments reported in the literature of the subject shew general conformity with the same law. The law is then generalized to give a modified coefficient applicable to an "infinite" field, and from this is deduced an expression for the average relative efficiencies to be expected for randomized block experiments with varying numbers of plots per block. Formulae are deduced from this for the estimation of the most efficient size of plot for any given experiment, knowing the nature of the heterogeneity over the area. J. W.

1012. "STUDENT" 631.421:519.24
Comparison between balanced and random arrangements of field plots.
Biometrika 1938 : **29** : 363–79.

NEYMAN, J. and
PEARSON, E. S.
Note on some points in "Student's" paper.
Ibid. 1938 : **29** : 380–88.

"Student" has previously pointed out that the advantages of artificial randomization in field experiments are usually offset by an increased error when compared with balanced arrangements. This point was disputed in a paper by Barbacki and Fisher. In this paper the author discusses at the outset the difference of opinion. He says that lack of randomness may be a source of serious blunders to careless or ignorant experimenters, but when, as is usual, there is a fertility slope, balanced arrangements tend to give mean values of higher precision compared with artificial arrangements. Balanced arrangements more often fail to describe small departures from the "null" hypothesis as significant than do random, though they make up for this by ascribing significance more often when the differences are large. In the really important agricultural experiments which are carried out at more than one centre, the very slight disadvantage that an occasional result at an individual station may not be recognized as significant owing to over-estimation of the error at that station is more than offset by the greater precision of the experiment as a whole.

The author then gives arguments to shew that the conclusions of Barbacki and Fisher all follow firstly from their having made use of a method of calculating the error of the "systematic" arrangements which he shewed fourteen years ago would lead to just the misleading conclusions which they have found, and secondly from their not having compared like with like.

Thirdly, the author examines afresh the data of Barbacki and Fisher and shews that in this case a balanced arrangement does in fact give a slightly smaller error than their randomized one. The author further describes just what is to be expected from the theoretical point of view, when balanced arrangements are compared with random, namely that when the variance due to treatment is low compared with the error of the experiment, fewer significant results are obtained than with random arrangements, but when the variance due to treatments is high more significant results are obtained with balanced arrangements.

The results of testing balanced versus random arrangements on uniformity trials by A. W. Hudson of Massey College, New Zealand, are included in an appendix to the paper.

The authors of the separate note make comments on certain points in the main paper, which the author was prevented from enlarging upon owing to his death on 16th October last. These take the form of adding details concerning the half-drill strip method of experimentation, and of discussing "Student's" analysis of variance of a balanced arrangement. J. W.

1013. WISHART, J. 631.421:519.24
Field experiments of factorial design.
J. Agric. Sci. 1938 : **28** : 299–306.
The point is made that when in the analysis of field experimental results there are a large number of effects based upon single degrees of freedom, it is possible that one or more may reach the customary significance level by chance. A supplementary homogeneity test is proposed to test this point, and is illustrated from a paper by Brandt, and also from a uniformity trial on asparagus. J. W.

1014. HUTCHINSON, J. B. and
PANSE, V. G. 631.421:575:633
Studies in plant breeding technique. II. The design of field tests of plant breeding material.
Indian J. Agric. Sci. 1937 : **7** : 531–64.
Consideration is given in this paper to the technique of replicated progeny row trials. The standard randomized block lay-out was adapted to this work by reducing the plot size to a single row 5 ft. or 10 ft. long. Examples are given of the standard errors obtained in work with a number of crops of different habits and seasons of growth, and it is shewn that with ten replications, standard errors of ten per cent of the mean, or less, may be expected for yield, and for characters such as staple-length and ginning percentages in cotton, they may be as low as two or three per cent. A compact family block design is used for testing groups of progenies belonging to related families, and a method is suggested for overcoming the difficulties of very unequal amounts of seed from different parent plants. It is concluded that the replicated progeny row technique is more efficient, more flexible, and of much wider application, than any other method. J. W.

1015. GILBERT, S. M. 631.421:633.73
Plot size in field experiments with *Coffea arabica*.
Trop. Agriculture, Trin. 1938 : **15** : 52–55.
Data were obtained in 1934, 1935 and 1936, from two uniformity trials on different estates. In the first the variety was Blue Mountain, planted in 1932 and in the second Kents, planted in 1927. The best plot size in each case was found to be 20 trees and in the first, with the younger and more irregular trees, it was desirable to combine the yields for three years, while combining two years' yields produced a considerable drop in the standard error per plot in the second case, where the trees were older and of more even performance.

1016. HOBLYN, T. N. and
EDGAR, J. L. 631.421:634.723–1.557
A study of the technique of variety trials, as illustrated by the comparative yields of four black currant varieties grown in three different localities.
J. Pomol. 1938 : **15** : 326–37.
The authors examined the yield data of four varieties of black currant over a five-year period. The experiment was an extensive one, there being six 4 × 4 Latin squares of 4-bush plots at each of three stations. Exceptionally accurate results followed from the method of design adopted, and differences in yield of from 6 to 8 per cent were demonstrated as significant. It was further concluded that three or four 4 × 4 Latin squares are necessary for reasonable precision at a single station, but two are adequate if the experiment is repeated at two or three stations. J. W.

1017. EDGAR, J. L. 631.421:634.75
Strawberry cultivation studies. II. Variability in individual plant size and cropping, with special reference to area and shape of plots for field experiments.
J. Pomol. 1938 : **16** : 91–100.
Knowledge gained on the question of variability from previous uniformity trials with large

plots led to the setting up of a new trial with clonal material in which the produce of individual plants was recorded. This enabled a study of the best size and shape of plot for experimental work to be undertaken. Plots of about 1/200 acre, containing 50 plants at 3 ft. × 1 ft. 6 in., repeated four times, are shewn to be sufficient to prove a 10 per cent difference. Smaller plots (1/400 acre), with slightly higher replication (five fold) are shewn to be quite practicable, if economy in ground is desired, if guard rows need not be considered, and provided disease is kept under control. Square plots are always more efficient than long narrow ones.

J. W.

PLANT DISEASES 632

1018. Johnson, T. and
Newton, M. 632.452:575.14:575.11

The origin of abnormal rust characteristics through the inbreeding of physiologic races of *Puccinia graminis tritici.*

Canad. J. Res. 1938 : **16** : Sect. C : 38–52.

The abnormalities described involve changes in uredial colour, decrease in pathogenicity, production of uredia which fail to burst the epidermis, loss of ability to produce aecia on barberry and the development of uredia and telia on barberry by strains which have lost the ability to produce aecia. Many inbred strains, however, shew no abnormal characteristics.

The appearance of these abnormal forms after selfing is attributed to the segregation of recessive mutants. Their absence in the field may be attributed to the absence of selfing under natural conditions and also to their reduced survival value.

1019. 632.452:633.1(71)
633.13–2.452–1.521.6:575(71)
Newton, M. 633.13 Vanguard

The cereal rusts in Canada.

Emp. J. Exp. Agric. 1938 : **6** : 125–40.

A concise, general account, describing the distribution, perpetuation and the losses caused, the distribution and prevalence of physiological races, the importance of barberry in the origin of new races and finally the breeding of varieties resistant to cereal rusts. It is considered that the introduction of the new rust-resistant wheats, which are derived ultimately from interspecific hybridization, may mark a new era in grain growing in Western Canada. The varieties mentioned are Renown (Reward × H–44–24), Apex [Marquis × (F_1, H–44–24 × Double Cross)] and Thatcher [(Marquis × Iumillo) × (Marquis × Kanred), the same parentage as Double Cross]. In addition to these wheats, the oat variety Vanguard is also mentioned as resistant to stem rust. Vanguard was developed by the Dominion Rust Research Laboratory, Winnipeg, from a cross between Banner and Hajira, and was distributed in the Prairie Provinces this year.

1020. Georgi, C. D. V. and
Teik, G. L. 632.951.1:581.192.6:575.42

Further selection experiments with *Derris malaccensis.*

Malay. Agric. J. 1938 : **26** : 4–17.

Data are presented concerning the weight of air-dry marketable roots per plant, the rotenone percentage, ether extract percentage and proportion of rotenone to ether extract in three varieties of *D. malaccensis*, namely var. *sarawakensis*, Tuba merah and Kinta type. The rotenone content in this species is too low to allow marketing on a basis of rotenone, and it can be sold only on a basis of ether extract. Selections have been established as cuttings from plants with high ether extract. Of the three varieties, *sarawakensis* is the best.

1021. 633.11(54)
633.11 *T. dicoccum* var. *Indicum*
BHATIA, G. S. 633.11:581.9
Cytology and genetics of some Indian wheats. I. A new variety of "Khapli Emmer" wheat from India, and its bearing upon the place of origin of emmer wheats.
J. Genet. 1938 : **35** : 321–30.

A new variety of Khapli emmer, named *Triticum dicoccum* var. *Indicum*, is described. It is characterized by a three-veined coleoptile, fragile rachis, three awns per spikelet, white, pubescent glumes and red grain. Discussing the centre of origin of emmer wheat the author suggests those places in which wild emmers are now found, such as Caucasia, Armenia, Palestine and Syria, rather than Abyssinia.

The sparse and patchy distribution of emmer wheats throughout the world is attributed to their being a vanishing crop.

1022. BREAKWELL, E. J. and 633.11:575(94.2)
HUTTON, E. M. 633.13:575(94.2)
Cereal breeding and variety trials at Roseworthy College, 1936-37.
J. Dep. Agric. S. Aust. 1938 : **41** : 551–64.

While in the preceding report (Cf. "Plant Breeding Abstracts", Vol. VII, Abst. 1098) emphasis was placed on baking quality as an aim in the breeding work, this year most attention is devoted to disease resistance. In wheat breeding, resistance to stem rust (*Puccinia graminis tritici*), flag smut (*Urocystis tritici*) and bunt (*Tilletia tritici*) respectively is tested in the course of selection. Some attention is paid also to reaction to leaf rust (*P. triticina*). Rust-resistant wheats from Kenya are considered very promising parents for breeding stem rust-resistant varieties.

In oats, hybrids with parents resistant to smut (*Ustilago avenae* and *U. levis*) are to be tested for resistance.

In the selection work with the wheat varieties Ford and Sword, 8 strains from Ford, with better baking quality and less shattering than the commercial strain, are being carried on, while one selection from Sword is to be renamed and released after the 1937 harvest. This selection, Sword 13, is superior in baking quality to commercial Sword, holds its grain well, is earlier, free from purple straw, more resistant to stem rust and outyielded commercial Sword last season.

The performance of certain hybrid strains with regard to yield and quality (Pelshenke test) is shewn in tabular form. The results of variety trials with wheat and oats are given.

1023. 633.11:575(94.5)
Victorian wheat varieties—Advisory Committee's recommendations.
J. Dep. Agric. Vict. 1938 : **36** : 133–44.

In addition to information on recommended varieties and results of yield trials, brief notes are given on new hybrid strains. Ranee × Free Gallipoli 5807 J 5–1–1 is recommended for release as a very early wheat in the Mallee. Ghurka Selection W 595–0–5 is superior to the Ghurka now commonly grown in grain and flour quality and in resistance to flag smut, and is considered the most important of the new wheats. Further tests are to be conducted with Major × Free Gallipoli W 5817 and Major × Ranee W 6025. Free Gallipoli × Sepoy L 5053 B 2 is superior to all the above in quality, but tends to have a low yield. Out of seventeen families selected for grain quality from a Ghurka × Canadian White Fife cross, two were equal to Ghurka and Free Gallipoli in yield in 1937 and superior in grain.

1024. MACINDOE, S. L. 633.11:575"793":581.143.26.03
Australian "winter" wheats would have many advantages.
Agric. Gaz. N.S.W. 1938 : **49** : 9–10, 38.

The substance of this article is contained in the paper reviewed in "Plant Breeding Abstracts", Vol. VIII, Abst. 691.

1025. Pal, B. P. and
Alam, N. 633.11:575.125:581.02
The effect of certain external factors upon the manifestation of hybrid vigour in wheat.
Proc. Indian Acad. Sci. 1938 : **7** : Sect. B : 109–24.

Reciprocal hybrids between the *Triticum vulgare* varieties Pusa 52 and Pusa 165 were compared with their parents in different seasons, with different dates and times of sowing, different depths of sowing and different conditions of spacing. The reciprocal hybrids behaved alike under all conditions.

The manifestation of hybrid vigour in the F_1, as measured by ten different characters, was found to be influenced by the environmental conditions, to different degrees according to the character considered. It is suggested that in those crops in which commercial application of heterosis is practicable, studies might be made to determine the optimum conditions for the expression of hybrid vigour.

1026. Bhatia, G. S. 633.11:575.127.2:576.356.5
Cytology and genetics of some Indian wheats. III. An octoploid amphidiploid F_1 hybrid from *Triticum vulgare* var. *graecum* Kcke × *T. dicoccum Indicum*.
J. Genet. 1938 : **35** : 331–49.

Most of the seeds obtained from reciprocal crosses between *T. vulgare* var. *graecum* and *T. dicoccum* var. *Indicum* either failed to germinate or gave seedlings which died at an early stage. One F_1 plant, however, derived from a large seed of the cross *vulgare* × *dicoccum* survived and produced ears. Observations on meiosis in the pollen mother cells shewed that it was octoploid. Its meiosis was quite regular and 28 bivalents were produced at metaphase I. This is the plant referred to by the author as amphidiploid. He suggests that it has been produced by doubling of the *vulgare* chromosomes in the fertilized egg cell. A description of the plant is given.

1027. Kostoff, D. 633.11:576.312.31
Heterochromatin at the distal ends of the chromosomes in *Triticum monococcum*.
Nature, Lond. 1938 : **141** : 690–91.

The ends of the root-tip chromosomes of *T. monococcum* were observed to stain more deeply than the rest of the chromosomes under certain conditions. It is suggested that the ends may be hetero-chromatic, and that this is responsible for the end-to-end associations of diakinesis chromosomes reported in haploid *T. monococcum*.

1028. Kostoff, D. 633.11:576.312.31:575.17
The most probable place of location of the genes in the chromonemata.
Nature, Lond. 1938 : **141** : p. 749.

The author has differentiated heterochromatic regions in the late prophase and early metaphase chromosomes in root tips of *Triticum Timopheevi*. Considering these to represent chromomeres and considering heterochromatic regions in general to be inert, he argues that the genes must be located between the chromomeres.

1029. Neatby, K. W. and 633.11–1.557:581.192
McCalla, A. G. 633.16–1.557:581.192
Correlation between yield and protein content of wheat and barley in relation to breeding.
Canad. J. Res. 1938 : **16** : Sect. C : 1–15.

Data from yield tests of varieties and breeding strains in Canada and the U.S.A. are used to shew that there is a marked negative correlation between yield and protein content as determined genetically in wheat and barley. The importance of this for breeding work is discussed.

1030. 633.11–2.452–1.521.6
633.11 Coronation
633.11 Renown

Bees, H. B.

Rust-resistant wheat—a triumph for science.

Field 1938 : **171** : p. 829.

In this popular account of the North American work on rust-resistant wheat, the following new resistant varieties are mentioned: Thatcher, Apex, Renown and Coronation.

OATS 633.13

1031. Hadfield, J. W.,
Smith, J. M. and
Woodcock, J. W. 633.13:575(42.59 + 93.1)
633.13 Resistance

Characteristics of Resistance oat. Field experiments in New Zealand.

N.Z. J. Agric. 1938 : **56** : 27–30.

The outstanding advantages of the new variety Resistance, bred by Dr Hunter at Cambridge, have been found to be its heavy yield of grain and straw, its exceptional resistance to lodging and its recovery after winter and early spring grazing. It is considered to be a very suitable variety for the South Island.

The disadvantages mentioned are that it is too susceptible to leaf rust for general use in the North Island, it is about a week later in maturity than Garton's Abundance, and in comparison with the latter, its grain has a higher proportion of seconds and husk.

MILLETS AND SORGHUMS 633.17

1032. Rangaswami Ayyangar, G. N. and
Achyutha Wariar, U. 633.171:581.46:575.11–181.12

Inheritance of glume length in *ragi, Eleusine coracana* (Gaertn), the finger millet.

Madras Agric. J. 1936 : **24** : 132–34.

A variety of ragi from Nyasaland was characterized by long glumes. The inheritance of this character was studied in crosses with normal, short glumes. It was found that short glumes are produced by the action of three dominant genes, $G\,l_1$, $G\,l_2$ and $G\,l_3$; if one of these is missing a medium length glume is produced and if two or all are absent, the long glume results. In F_2 segregation into 27 short: 27 medium: 10 long was obtained.

RICE 633.18

1033. Sethi, R. L.,
Sethi, B. L. and
Mehta, T. R. 633.18:575.11"793"

Inheritance of earliness in United Provinces rices, II.

Indian J. Agric. Sci. 1938 : **8** : 1–20.

Flowering duration (defined as the number of days between sowing and commencement of flowering) in four crosses between a *sathi* (sixty-day) rice variety, T 131 and the fine-grained varieties, T 1, T 2, T 7 and T 12, was studied. The latter belong to the early group of United Provinces rices but were definitely later than T 131. The results from all four crosses were similar, and therefore only the data from one cross (T 131 x T 1) are given in detail. The mean of the F_2 population approached the mean of the late parent and shewed a higher standard deviation than either parent, the range extending from the lower extreme of the early parent to appreciably beyond the upper extreme of the late parent. The continuous range obtained in F_2 suggested the operation of multiple factors, but it was not possible to estimate the number of factors responsible for the inheritance of flowering duration in this cross. The F_3 generation was also studied and it was found that there was a tendency for the F_3 durations to resemble the F_2 parental durations, the correlation coefficient between the two sets of durations being + 0·726. The very early and the very late F_2 plants, however, gave F_3 progenies whose mean durations shewed some regression towards the general mean.

B. P. P.

1034. Ramanujam, S. 633.18:576.312.35
Cytogenetical studies in the *Oryzeae* I. Chromosome studies in the *Oryzeae*.
Ann. Bot. Lond. 1938 : **2** : (N.S.) : 107–25.
The following chromosome numbers are reported: *Zizania aquatica* L., n = 15, 2n = 30, *Z. latifolia* Turch., 2n = 30, *Oryza sativa* L., 2n = 24, *O. glaberrima* Steud., n = 12, 2n = 24, *O. officinalis* Wall., n = 12, 2n = 24, *O. Barthii* Cheval., n = 12, 2n = 24, *O. minuta* Presl., n = 24, 2n = 48, *Leersia oryzoides* Sw., 2n = 48, *L. hexandra* Sw., 2n = 48, *Hygroryza aristata* Nees., 2n = 24 and *Lyglum spartum*, n = 20, 2n = 40.
The phylogeny of the group is discussed in relation to these findings.

1035. Sethi, B. 633.18:576.312.35:576.312.34
Cytological studies in paddy varieties.
Indian J. Agric. Sci. 1937 : **7** : 687–704.
The chromosomes and chromosome behaviour of a number of rice varieties differing widely in morphological characters were studied, both anthers and root-tips being used. All the varieties were found to have twelve and twenty-four haploid and diploid chromosomes respectively. The complements of different varieties however shewed variations in chromosome morphology, and it is considered that "chromosome constitution" is responsible for the varietal differences exhibited by each strain.
A positive correlation was noted between meiotic irregularities and sterility. B. P. P.

1036. Williamson, J. A. 633.18–1.531.12:575(94.4)
Pure seed rice. Bulk production at the Rice Research Station, Yanco.
Agric. Gaz. N.S.W. 1938 : **49** : 128–30.
An account of the production of pure seed rice at Yanco. The quantity produced per annum, 100 tons, is great enough to allow the total rice crop grown in Australia to be only one generation removed from the station seed. One of the station selections thus multiplied, Late Caloro, is considered to be probably the highest yielding rice in the world, and has yielded a return of as much as 4 tons (216 bushels) per acre. Other selections are the mid-season Caloro 2 and two early varieties kept for emergency late sowings.

1037. Ramiah, K. and
Hanumantha Rao, K. 633.18–2.183–1.521.6:575.11
Inheritance of grain shattering in rice (*Oryza sativa*).
Madras Agric. J. 1936 : **24** : 240–44.
The type of shattering characteristic of wild rice is inherited as a simple recessive.
Varietal differences in degree of shattering exist among cultivated rices. To estimate degree of shattering panicles were taken 40 days after flowering and placed on an inclined plane where a weighted roller was allowed to pass over them. The number of grains shed gives a measure of susceptibility to shattering. To save time the varieties used in the inheritance study were chosen with approximately equal numbers of grains in the panicle. One parent gave an average of 3·54 ± 0·13, the other 34·30 ± 0·53. The F_1 was intermediate. The F_2 data did not shew any simple Mendelian ratio, the mean shedding was 12·34 ± 0·21. In F_3 families the correlation with the F_2 was + 0·48 ± 0·023.

LEGUMINOUS FORAGE PLANTS 633.3

1038. Williams, R. D. 633.321:575.11
Genetics of red clover and its bearing on practical breeding.
Rep. 4th Int. Grassland Congr. Aberystwyth 1937 : 238–51.
The speaker begins by testifying to the value of genetics in plant breeding.
Considerable attention has been devoted at Aberystwyth to the study of self and cross-incompatibility, which is of the greatest importance in the development of an efficient breeding technique. Self-sterility is the normal condition in red clover and is determined by a series of multiple allelomorphs acting as oppositional factors. A small proportion of plants are

capable of producing a few selfed seeds as a result of pseudo-self-fertility and from such plants progeny homozygous for different allelomorphs of the *S* series can be obtained. A large proportion of plants selected for inbreeding often are cross-incompatible and it is therefore advisable to make preliminary compatibility tests before starting the main pollination programme. Cross-incompatibility rarely occurs between plants of different origin. This is due to the fact that red clover has a very extensive series of multiple allelomorphs of the sterility factors. Among 20 plants selected at random from a commercial sample of Montgomery red clover, no fewer than 34 different allelomorphs were found.

In one out of several thousand plants tested a self-fertility factor *Sf* was found; a pollen tube carrying this factor can grow down the style, irrespective of the self-sterility factors carried by the latter. The self-fertility factor has been very useful in genetical studies, but from the breeding point of view it would be an adverse factor, owing to the loss of vigour which follows inbreeding.

Data are given to shew the loss of vigour on inbreeding. It was found that though there was a general loss of vigour, some inbred families were much more vigorous than the rest, the difference being more pronounced in the third year of growth than in the second. Such families are very prepotent in outcrosses and are therefore exceedingly valuable for the production of improved strains.

In inheritance studies, 152 recessive chlorophyll deficiencies have been found, most of which have been shewn to be different genetically. Not all of them are lethal. Of 22 plants from a commercial population, 13 were found to be heterozygous for chlorophyll deficiency, a total of 22 different recessive chlorophyll mutants being obtained from them. In the heterozygous condition these factors have, as far as can be observed by inspection, no deleterious effect on the plant, but investigations on this point have been begun. Another type of lethal mutant is intensely dark green and dies in the cotyledon stage. Dwarf and semi-dwarf mutants of various types are of frequent occurrence in inbred cultures and a number of recessive genes influencing the growth of specific organs have also been identified. Other factors, such as those influencing pubescence and flower colour, have no effect on plant growth and might be used to distinguish new strains.

The linkage relations of 37 factors have been investigated and five of the seven possible linkage groups have been found. The approximate loci of certain genes in the first chromosome are given. It carries nineteen genes, affecting leaf marking, chlorophyll deficiency, pubescence, plant and flower colour, a dwarf and a gametic lethal. The second chromosome carries six genes, including the self-sterility factors, three flower colour factors and two chlorophyll deficiency factors; factors linked with *S* frequently give segregations deviating widely from expectation. The third chromosome carries *cy* (white flower) and three chlorophyll deficient factors, chromosome IV a factor for adpressed stem hairs, a factor for stem fasciation and two factors for chlorophyll deficiency and chromosome V a glabrous and three chlorophyll deficiency factors.

1039. Luthra, J. C. 633.329:581.142

How to raise good seed of berseem.

Seasonal Notes Punjab Agric. J. 1932 : **9** : 9–10.

It is mentioned that the yellow, brown and black seeds found in samples of *Trifolium alexandrinum* seed have different germination percentages: yellow 88, brown 44 and black 26.

ROOTS AND TUBERS 633.4

1040. 633.426:575(93.1)
633.426 Giant rape

Certified giant rape.

N.Z. J. Agric. 1938 : **56** : p. 125.

Giant rape, a selection made by the agronomist of the New Zealand Plant Research Bureau, has shewn great superiority over commercial broad-leaf Essex rape in trials in the Manawatu, Wanganui and Hawke's Bay districts.

1041. HOWARD, H. W. 633.426:576.312.35
The chromosome number of the swede, *Brassica napus* L.
J. Genet. 1938 : **35** : 383–86.
In root-tips, 2n = 38 was found, and at metaphase I, anaphase I and metaphase II in pollen mother cells, n = 19. This agrees with the results of Japanese workers but contradicts those of European workers, who have given n = 18 and 2n = 36.

FIBRES 633.5

1042. MASON, T. G. 633.51:575
A note on the technique of cotton breeding.
Emp. Cott. Gr. Rev. 1938 : **15** : 113–17.

EVANS, G.
Note on Dr Mason's article on the technique of cotton breeding.
Ibid. 1938 : **15** : 118–20.
Dr Mason emphasizes the importance of the primary selection and suggests that more attention should be devoted to this point, coupled with efforts to increase the variability of the material from which the first selection is to be made. Acclimatization is also discussed.
Sir Geoffrey Evans expresses disagreement with some of Dr Mason's points.

1043. BURT, B. and
MAHTA, D. N. 633.51:575(54)
The Indian Central Cotton Committee and its work.
Emp. Cott. Gr. Rev. 1938 : **15** : 93–104.
An account of the work of cotton improvement in which the Committee takes an interest. The topics covered include the extension of improved varieties of cotton and legislation to preserve their purity, breeding work and the work of the Technological Laboratory.

1044. 633.51:575(54.8)
NEELAKANTAN, L. 633.51 Nandyal 14
The present position of strain Nandyal 14 in the "Northerns" area.
Madras Agric. J. 1936 : **24** : 368–71.
Nandyal 14, a variety bred by the Madras Agricultural Department with a yield of 200 lbs. of seed cotton per acre and capable of spinning up to 40's has never been very popular and has recently dwindled in acreage. This is probably to be attributed to its low ginning out-turn, susceptibility to red leaf disease and the decline in the premium paid for its produce; the variety appears to thrive only in red and mixed soils.
In the meantime the crop in the "Northerns" area of Madras is becoming more and more mixed, and a strain similar to Nandyal 14 in quality but with a better yield and ginning percentage and better suited to a wide range of soil and rainfall conditions is required to replace the mixture. Selection from field crops is being performed by the Nandyal Agricultural Research Station and three heavy-yielding strains have been established. These are to be tested at various centres in the tract in comparison with local cottons. It is possible that different strains may be found particularly suited to different zones, but this need not affect the produce coming on the market as the resulting mixture would be composed of types with similar spinning properties.

1045. 633.51:575(54.9)
633.51 Gaorani 6
A new variety of cotton for Madhol Tuluqa.
Leafl. H. E. H. Nizam's Agric. Dep. Hyderabad No. 6 of 1346 F : 1 page.
The new variety, Gaorani 6, evolved from the local Madhol variety, has a higher yield and a higher ginning out-turn.

1046. HUTCHINSON, J. B. 633.51:575(72.9)
Note on the advantages of centralising cotton breeding work in the British West Indies.
Rep. 2nd Ord. Gen. Mtg. W. Indian Sea Island Cott. Ass. (Incorporated) Antigua 1937 (1938) : p. 19.
In view of the refinement of modern plant breeding technique and the amount of computational work involved, it is considered that cotton breeding for the British West Indies can be advantageously centralized at the St. Vincent and Montserrat stations, with variety trials in the other cotton-growing islands.

1047. 633.51:575(72.97)
HUTCHINSON, J. B. 633.51–1.531.12(72.97)
Memorandum on the production of pedigree seed of Montserrat Sea Island cotton.
Rep. 2nd Ord. Gen. Mtg. W. Indian Sea Island Cott. Ass. (Incorporated) Antigua 1937 (1938) : p. 20.
It is proposed that all the cotton-growing islands of the Leeward Islands should adopt the Montserrat Sea Island strain and that all breeding work on the strain should be concentrated in Montserrat. A scheme for the multiplication of selected strains is described.

1048. EVELYN, S. H. 633.51:575(72.98)
Progress report on the Sea Island cotton breeding work at the Cotton Experiment Station, St. Vincent, B.W.I.
Rep. 2nd Ord. Gen. Mtg. W. Indian Sea Island Cott. Ass. (Incorporated) Antigua 1937 (1938) : 23–25.
Data are given on strains selected from V 135 for high weight of lint per seed and high ginning out-turn, on the Red Sea Island strains, whose lint length (57–60 mm.) is now considered a stable character and on the V 135—Montserrat hybrids. Selection in the last series of hybrids was based on the three lint lengths, 57 mm. and over, 53–55 mm. and 50–52 mm.
The first back-cross (Gambia x V 135) x V 135 was obtained. The Gambia parent is a very prolific sympodial Bourbon which has shewn high resistance to the common fungoid and bacterial cotton diseases in St. Vincent. The F_1 plants were not affected in spite of the bad season. The work on back-crosses between V 135 and the wild species *Gossypium aridum*, *G. trilobum* and *G. armourianum* was continued, but is to be stopped as better facilities exist at Trinidad for studying these hybrids.
Progenies were examined of Sea Island commercial cottons of Barbados, Montserrat and St. Vincent in which naked seeds had been discovered.
The genetic experiments with Sea Island strains were continued (Cf. also "Plant Breeding Abstracts", Vol. VII, Absts. 863 and 1122).

1049. HUTCHINSON, J. B. and
GHOSE, R. L. M. 633.51:575.11.061.6
A note on two new genes affecting anthocyanin pigmentation in Asiatic cottons.
Indian J. Agric. Sci. 1937 : **7** : 873–76.
A new member, Red spotless, R_2^o, of the anthocyanin series is described, and its position in the series established. The existence of a petal spot reducer, *Sr*, in a strain of cotton from Nagpur, is also demonstrated. B. P. P.

1050. 633.51:575.127.2(75.9 + 75.8)
Sea Island cotton in Florida.
Trop. Agriculture, Trin. 1938 : **15** : p. 104.
It is mentioned that Sea Island cotton has been crossed with extra-long staple Upland cottons in the hope of combining the long silky fibre of the former with the greater yield, larger bolls and early maturity of the latter. The F_1 was grown in 1936 and back-crossed to each parent.

1051. Vijayaraghavan, C., Kesava Iyengar, N. and Venkoba Rao, M. 633.51:581.162.51:575.11
A heritable case of female sterility in *Herbaceum* cotton.
Madras Agric. J. 1936 : **24** : 365–68.
The type of female sterility described in the article reviewed in "Plant Breeding Abstracts", Vol. V, Abst. 22, is found to be due to a single recessive factor, *stg*. Pollen placed on the short style apparently fails to germinate.

1052. Hancock, H. A. 633.51:677.1:578.081(62)
Egyptian cotton: studies in spinning and growing, 1935-36.
Bull. Minist. Agric. Egypt 1938 : No. 189 : Pp. 58.
The Spinning-Test Mill at Giza is primarily concerned in the search for new Egyptian varieties which shall be more acceptable both to grower and to spinner. It is equipped for carrying out fine spinning, for which purpose the temperature and humidity inside the mill are rigidly controlled by insulation and air-conditioning.
The present bulletin contains an account of the spinning procedure adopted for cotton samples and of investigations on spinning technique and on the effect of different factors on yarn strength. The results of spinning tests performed for plant breeders are not given.

1053. Imai, Y. 633.522:575.18.061.6
Sex-linked mutant characters in the hemp, *Cannabis sativa*.
J. Genet. 1938 : **35** : 431–32.
Two viable chlorophyll mutations induced by X-ray treatment of pollen were inherited as sex-linked characters. The male is heterozygous in hemp.

1054. Doughty, L. R. 633.526.2:575(67.8)
Experimental breeding of fibre Agaves in East Africa. Part II. The progress of breeding at Amani.
E. Afr. Agric. J. 1938 : **3** : 268–78.
Brief accounts are given of the outstanding characteristics of *A. angustifolia* Harv., *A. amaniensis* Trelease and Nowell, *A. cantala* Roxbg., *A. fourcroydes* Lemaire and *A. sisalana* Perrine. Other species of the *Rigidae* group of *Euagave* in the Amani collection are *A. nirvana*, *A. fortuna* (unpublished names), *A. decipiens* Baker, *A. miradorensis* Jacobi, *A. Lespinassei* Trelease, and *A. Zapupe* Trelease. In most species the proportion of fibre to leaf is about the same as that for sisal, and there is therefore little prospect for improvement in this respect. *A. sisalana* is a pentaploid (Cf. "Plant Breeding Abstracts", Vol. VII, Abst. 430) and fruiting cannot be induced at Amani, but seeds have been obtained from other parts of East Africa. Some 14,000 seedlings have been raised and they shew a great range in vegetative characters and in size, from giant to dwarf. This variation is to be expected from the numerical hybridity of the species. None of the seedlings which have poled so far have been outstandingly productive, but a further trial of the vegetatively propagated offspring of the most promising seedlings is projected in co-operation with the Sisal Experiment Station, Ngomeni.
Seedlings of *A. angustifolia*, a fertile diploid, shew a wide variation in rate and total quantity of leaf-production, but not as wide as in *sisalana* seedlings. Seedlings of both species have spiny leaf margins.
A list of 13 crosses made or attempted is given, with data indicating the degree of success and the proportion of plants with non spiny margins. In 1932, 235 F_1 plants from the cross *A. angustifolia* x *A. sisalana* were planted in the field and were cut for the first time in 1936. Here again a wide range was encountered and nine plants gave a yield of over 100 lbs. of leaf as compared with about 70 lbs. for *A. sisalana* bulbils in an adjoining plot. All plants had spiny margins. The next two crosses are chiefly of genetic interest, being reciprocals between *A. angustifolia* and *A. ingens* var. *picta*, a tetraploid species of the *Americanae* group. Reciprocal crosses between the diploid forms *A. amaniensis* and *A. angustifolia* var. *marginata* have given a proportion of seedlings with non-spiny leaf margins. Planted out in 1936,

these hybrids are making good progress and it appears that the rapid growth habit of *angustifolia* is dominant. F_1 plants of *A. amaniensis* x *A. sisalana* made slow growth in the early stages and were planted out in April, 1937. A wide range of variation is already visible.
In the cross *angustifolia* x *sisalana*, cross-sections of leaves indicate that the variation affects fibre properties. In fibre tests the two measures used are the metric number (length in kilometres of single fibre weighing 1 kilogram), a measure of fineness and breaking length (length of fibre in kilometres which if suspended at one end would break under its own weight), a measure of strength. Values for these two measures are given for *A. sisalana*, experimental and estate material, seedlings of *A. sisalana*, a Java sample of *A. cantala* and *A. amaniensis*.
In general, though the seedlings of polyploids offer a wide range of variation for selection, it is considered that the most promising line for breeding is provided by the inbred seedlings and hybrids of the diploid species, especially if the hybrids prove to be fertile.

1055. 633.526.2:575(67.8)
LOCK, G. W. 633.526.2:575.127.2
Notes on breeding fibre *Agaves* at Amani.
Quart. Notes Sisal Exp. Sta. Tanganyika 1936 : No. 3 : 6–8.
A brief account of the breeding work by the Geneticist, L. R. Doughty.
Sisal (*A. sisalana*) is the most important species in cultivation, characterized by a non-spiny leaf margin, adaptability to a wide range of soil and climatic conditions, and strong fibre of good appearance, though not perhaps as fine as could be desired. Its seedlings shew a wide range of variability and some appear to surpass the parent species in yield; all have the great disadvantage of spiny leaf margins.
Blue sisal (*A. amaniensis*), a species of unknown origin discovered on the Amani estate, has fine fibre, non-spiny leaf margin and heavy leaf, indicating a high total weight of fibre per leaf. It is sexually fertile.
A. angustifolia, a common ornamental and hedge plant in East Africa, is also sexually fertile and is characterized by rapid growth and very high total leaf-production. Its leaf, however, is short and has a spiny margin.
A. angustifolia has been crossed with *A. amaniensis* and about a quarter of the hybrid seedlings had non-spiny leaf margins. About 200 seedlings have been raised from the cross between sisal and blue sisal, and most of them have spiny leaf margins. Some seedlings from the cross between *A. angustifolia* and sisal shew promise of high yield and good fibre characteristics. No success has been obtained from attempts to cross maguey (*A. cantala*) with blue sisal, but further attempts are to be made.

1056. LOCK, G. W. 633.526.2:575.127.2
Agave seedlings and hybrids.
Quart. Notes Sisal Exp. Sta. Tanganyika 1937 : No. 7 : 12–13.
Certain hybrids from the cross *A. amaniensis* x *A. angustifolia* and the reciprocal, originally raised at Amani, are shewing good progress on the station. The best plants are producing about twice as many leaves monthly as common sisal, and it will shortly be possible to examine their fibre characteristics.
Seedlings from open-pollinated *A. fortunae* are the weakest of all.

1057. RAJASEKHARA MUDALIYAR, C. 633.528.2–2.112–1.521.6:575.127.2
A note on the interspecific cross in the Cucurbits.
Madras Agric. J. 1936 : **24** : 336–37.
A brief description of the hybrid between *Luffa acutangula* and the wild species *L. aegyptica*. The cross succeeded in either direction and a fairly large set of seed was obtained, though germination was very poor. The F_1 was intermediate in the characters studied (dissection of leaf, time of opening of flower, fruit shape and seed coat) and appeared to inherit some of the drought-resistance of the wild species. F_2 seeds failed to germinate.

1058. 633.584.3(42)

Burtt Davy, J. 633.584.3 *S. alba* var. *elyensis*

A new variety of *Salix alba* L.

J. Bot., Lond. 1938 : **76** : 141–43.

A new variety of *S. alba*, occurring in association with cultivated cricket bat willows (*S. alba* var. *caerulea*) is described and named *S. alba* var. *elyensis*. It is possibly derived from a cross with *S. fragilis*.

SUGAR PLANTS 633.6

1059. 633.61:575

Planters' Group. Jubilee of the sugar-cane seedling.

Suppl. Unit. Emp. 1938 : **29** : p. 7.

At a meeting of the Planters' Group of the Royal Empire Society on Thursday, 6th January, 1938, Mr W. G. Freeman read a paper tracing the history of varietal improvement in the sugar-cane.

1060. 633.61:575(54.8)

Breeding investigations in the sugar-cane.

Nature, Lond. 1938 : **141** : p. 340.

This summary of Rao Bahadur T. S. Venkatraman's presidential address to the Section of Agriculture of the recent Indian Science Congress gives a brief account of the breeding work at Coimbatore, including that on interspecific and intergeneric crosses.

1061. 633.61:575(69.82)

Bodkin, G. E. 633.61 M 171/30

Notes sur la variété M. 171/30. (**Notes on the variety M. 171/30.**)

Rev. Agric. Maurice 1937 : No. 95 : 182–84.

This variety from the cross R.P.6 x M.27 16 has recently been distributed, and proved to be of high yield and resistant to gumming disease.

1062. 633.61:575(72.9)

Fourth Annual Report of the British West Indies Central Sugar Cane Breeding Station, Barbados for the year ending September 30, 1937 : Pp. 34.

McIntosh, A. E. S.

Report of the Botanist for the year 1936-37.

Agric. J. Barbados 1937 : **6** : 109–32.

In 1936, 79 crosses were made, including proven and semi-proven crosses of noble canes (*Saccharum officinarum*) and nobilization of *S. spontaneum* (Indian, Celebes and Javanese forms), *S. Barberi*, *S. sinense* and crosses involving several species. The interspecific crosses made up the experimental group of crosses. A total of 82,930 germinating seeds were obtained and 14,473 seedlings were planted in the field nursery for the B.39′ series. In the first year seedling trial of the B.38′ series, 8,309 seedlings were planted out of the 14,647 in the field nursery from the crosses made in 1935.

The first year seedling trial of the B.37′ series, planted in October, 1935, was reaped. Among the crosses between noble canes (proven and semi-proven) the best crosses were of Ba 11569 with the male parents B.417, Ba 8069, B.6835, B.6450, B.H.10(12) and B.603. The crosses of Ba 11569 with S.C.12/4, Burke and D.625 have been eliminated. In the early group 60 and in the late group 53 seedlings were finally selected. The experimental crosses in this trial consisted of nobilizations. From the more advanced nobilizations 79 seedlings were selected for further testing in Barbados prior to selecting for tests in other parts of the West Indies; an analysis of the behaviour of the different hybrid populations is being made for future guidance. Among the earlier nobilizations, 29 selections for further nobilization were made.

In the second year seedling test for 1936–38 of the B.35′ series (noble canes), 53 seedlings were planted, 61 having been eliminated in the multiplication and minor selection plots

because of poor appearance in the field or susceptibility to gumming disease. The nobilizations of the B.35′ series have been tested in a second year seedling trial which represents a new type of trial, intended to give an adequate second year's test in Barbados of selected nobilized seedlings before making final selections for test in various British West Indian islands. This trial was planted in November, 1935, and the seedlings were divided into two groups:—(1) thick canes for better soil conditions where mosaic is present and (2) thin canes for poor soil areas. Seven thick-cane and six thin-cane seedlings were selected and despatched to Trinidad Plant Quarantine Station. Two of the thick-cane selections, B.35187 and B.35245 were considered promising for Barbados conditions, and are to be tested in select seedling trials and maturity experiments in Barbados in 1937–39.

From the second year seedling trial of the B.34′ series (noble canes), seven seedlings have been selected, and one of them, B.3439, is sufficiently promising to be tested in variety trials in 1937–39, as an early variety in the lower rainfall, black coral limestone soils; the others will be tested in select seedling trials and maturity experiments in the same season.

B.3307 and B.3327, selected from the second year seedling trials of the B.33′ series, are undergoing tests in select seedling trials and maturity experiments, 1936–38 season.

The select seedling and variety trials in which seedlings of the B.30′, 31′ and 32′ series were tested were carried out in localities representing different ecological conditions. Plant canes and first and second rattoons were tested in certain select seedling trials, and plant canes and first rattoons in variety trials. For the black and sandy coral limestone soils with low rainfall none of the varieties tested were better than the standard, B.2935; an earlier-ripening and stronger-rattooning seedling is still needed, and B.3307 and B.3439 are being tested for this purpose. For similar soils with low to intermediate rainfall none of the varieties tested as plant canes were outstanding, but B.3127 is to be tested further because of its behaviour in the first rattoons trial. In plant cane trials in the valley, deep, black coral limestone soil area with low to intermediate rainfall, B.3127 gave excellent yields and is being tested again. In trials in the red coral limestone soil area with intermediate to high rainfall, B.3013 was outstanding, especially in rattoons; B.3127 also shewed promise.

A list is given of the crosses made in 1936 with data on germination, numbers potted and numbers planted in the field nursery.

The growth measurements and maturity experiments have been continued, but there has been no gumming disease resistance trials for the present season owing to the change in organization of the station.

The root development investigations have been discontinued for the present.

The Zeiss Hand Refractometer has been used as an indicator of ripening (Cf. also "Plant Breeding Abstracts", Vol. VIII, Abst. 716).

Investigations on rotting of cane and rattooning of seedlings have been made.

A list is given of the crosses of which fuzz has been sent to Trinidad in connexion with the breeding for resistance to froghopper. Fuzz of certain crosses has also been sent to New South Wales and to Washington for Florida. Cuttings of 26 seedlings were sent to Trinidad for distribution in the British West Indies and cuttings of 20 seedlings were sent to Amani for Uganda.

B.726 and B.2935 are now being planted commercially in the islands served by the station.

1063. Janaki Ammal, E. K. 633.61:575.127.5:633.289:576.312.35

Chromosome numbers in sugarcane x bamboo hybrids.

Nature, Lond. (Suppl.) 1938 : **141** : p. 925.

The female parents in these crosses were P.O.J.213 and P.O.J.2725, the male parent being *Bambusa arundinacea* Willd. P.O.J.213 has 124, P.O.J.2725, 106–107 and *B. arundinacea* 72 somatic chromosomes. The P.O.J.213 x *B. arundinacea* hybrids had 96–100 chromosomes in the root-tips, and the P.O.J.2725 x *B. arundinacea* hybrids had 90. The viable hybrids therefore arise only from the fusion of reduced gametes of both sugar-cane and bamboo, in which respect they differ from sugar-cane x sorghum hybrids (Cf. "Plant Breeding Abstracts", Vol. V, Absts. 26 and 887). It is mentioned that in *Saccharum* x *Imperata* crosses viable hybrids arise only from the fertilization of diploid gametes.

1064. Evans, H. 633.61:581.162.3:578.08
L'isolement des inflorescences de la canne à sucre en vue d'effectuer des croisements. (**The isolation of the inflorescences of sugarcane for making crosses**).
Rev. Agric. Maurice 1938 : No. 97 : 12–19.

The solutions of sulphurous acid used in Hawaii for the preservation of the inflorescences of the sugarcane were not found to be satisfactory in Mauritius. Good results were, however, finally obtained with the following solutions:—

Sulphurous acid, 0·03 per cent
Phosphoric acid, 0·01 per cent
Calcium sulphate, 0·01 per cent
[Potassium chloride, 0·005 per cent
Urea, 0·001 per cent
Magnesium sulphate, 0·001 per cent
Glucose, 0·01 per cent].

The substances in brackets were made up into a separate solution of which 1 c.c. per litre was added to the preservative.

1065. L....., H. M. 633.61.00.15
The organization of sugar cane research.
Int. Sug. J. 1938 : **40** : 89–91.

The author contends that the research unit concerned with economic work should be an integral part of the industry and points out the advantage of this type of organization. Pure, or fundamental research should be a university activity and close liaison should be maintained between the two types of workers.

STIMULANTS 633.7

1066. Nicholls, W. H. 633.71:575.127.2
A new tobacco plant—a natural hybrid.
Vict. Nat. 1936 : **53** : p. 64.

A description of a natural hybrid between *Nicotiana glauca* Graham x *N. suaveolens* Lehm. found on the You Yang Range near Lara, Victoria.

1067. Subba Rao, M. K. 633.72:576.312.35
Chromosomes in *Camellia thea* (the tea plant).
Curr. Sci. 1938 : **6** : p. 457.

The chromosome number 2n = 30, n = 15 is confirmed in Indian material.

1068. Hall, C. J. J. van. 633.73:575(92.2)
Coffee selection in the Netherlands Indies.
Trop. Agriculture, Trin. 1938 : **15** : 87–90.

The work described in this account of coffee varietal improvement covers selection of clones, selection of seedling families, introduction of new species and varieties and inter-specific hybridization.

1069. S.M.G. 633.73:575.42(67.8)
Selection in *Coffea arabica*.
Quart. Notes Coffee Res. Exp. Sta. Tanganyika 1937 : No. 2 : p. 1.

S.M.G.
Selections.
Ibid. 1937 : No. 3 : 2–3.

Planters having coffee trees suitable for selection for vegetative propagation are invited to write to the Chief Scientific Officer. Trees should be vigorous, free from disease and producing a regular yield of 300 ounces or more of cherry per annum; the mean clean bean weight should be at least 0·2 grm. and the dried bean should be flinty.
In the second note instructions for preparing a sample of the beans are given.

AROMATIC PLANTS 633.8

1070. Imai, Y. 633.842:575.11.061.633
The mechanism of variegation in *Plantago* and *Capsicum*.
J. Genet. 1938 : **35** : 375–82.

Genotypically, variegation behaves as a double recessive in *Plantago major* var. *asiatica* and as a single recessive in *Capsicum annuum*. The somatic segregations and other phenomena occurring in the variegated plants are discussed in relation to the author's "plastogene" theory.

OIL PLANTS 633.85

1071. Mohammad, A. and
Sikka, S. M. 633.853.49:575.11
Breeding investigations in some of the oleiferous *Brassicae* of the Punjab.
Indian J. Agric. Sci. 1937 : **7** : 849–61.

The inheritance of four characters was studied in crosses between sarson (*Brassica campestris* L. var. *sarson* Prain) and toria (B. *napus* L. var. *dichotoma* Prain), and between yellow-seeded and brown-seeded forms of the former. The extrorse condition of anthers was found to behave as a simple dominant over the introrse condition. Similarly hairiness of leaf was dominant on a monogenic basis to the glabrous condition. The inheritance of seed-colour was more complex and evidently involves more than one factor. The inheritance of self-sterility was also found to be rather complex. It is tentatively suggested that the difference between self-sterility and self-fertility is monofactorial, the latter being recessive. B. P. P.

1072. Richharia, R. H. 633.853.55:576.354.46:576.356.5
A note on the cyto-genetics of *Ricinus communis* L.
Indian J. Agric. Sci. 1937 : **7** : 707–11.

Secondary associations were very common and were investigated at first and second metaphase, the maximum number being five. It is concluded that *Ricinus communis* is probably a secondarily balanced polyploid. B. P. P.

1073. Deshpande, R. B. and
Mallik, A. K. 633.854.54:575.11:581.48
Studies in Indian oilseeds. VI. Some correlations between oil-content and other characters in the Pusa linseed hybrids.
Indian J. Agric. Sci. 1937 : **7** : 841–48.

Oil-content was found to be negatively correlated with the intensity of the seed colour, the darker-seeded strains (brown and grey) having a lower oil-content than the strains with light seed-colours (fawn and yellow). The factor which converts yellow seed colour to grey and fawn to brown is apparently also responsible for the decrease in oil-content.

Seed-size was positively correlated with seed-colour but there was no correlation between seed-size and oil-content. B. P. P.

1074. Kadam, B. S.,
Kulkarni, R. K. and
Patel, S. M. 633.854.54:581.162.32
Natural cross-pollination in linseed.
Madras Agric. J. 1938 : **26** : 3–9.

Off-type plants with pale blue or white flowers, occurring in strains with blue flowers, were allowed to set seed by open-pollination. Since pale blue and white are recessive to blue the proportion of blue-flowered plants occurring in the progeny thus obtained gives a measure of the amount of cross-pollination. The average percentage of blue-flowered plants in 23 such progenies was 3·08, with a range from 0 to 6·75. Some of the blue-flowered plants thus obtained were harvested individually and in their progenies segregation into blue and pale-blue or white was observed, giving, with one exception, 3:1 ratios.

It thus appears that some measure of protection is needed to ensure self-pollination and it is mentioned that a better set of seed is obtained under muslin than under paper bags.

FRUIT TREES 634

1075. 634.25
BUNYARD, E. A. 634.256
The history and cultivation of the peach and nectarine.—I.
J.R. Hort. Soc. 1938 : **63** : 114–21, 170–77.
A brief account of the history of the peach, with information on early varieties.

1076. 634.3(68.9)
HALL, W. J. 634.31:575.42(68.9)
Citrus cultivation in Southern Rhodesia.
Emp. J. Exp. Agric. 1938 : **6** : 101–11.
The Valencia Late is the most important orange variety for the export trade. Du Roi and Leu Gim Gong are the other late varieties grown and the mid-season varieties are Mediterranean Sweet, Jaffa and Premier, the last being a strain developed locally from a few trees with constant, well-defined characteristics in the Jaffa groves on the estates of the British South African Company. Breeding work is confined to bud selection and the introduction of strains and varieties.

1077. BARNES, H. and
PREST, R. L. 634.3:575.42(94.3)
Citrus budwood selection in Queensland.
Qd. Agric. J. 1938 : **49** : 126–30.
Citrus budwood for distribution to nurserymen is selected by the Department of Agriculture and Stock from trees of outstanding merit in respect of health, vigour, size of crops, evenness of fruit and quality of fruit. It is provided by regulation that no trees of the better varieties shall be sold in Queensland unless they have been worked with buds selected by the Department.

NUTS 634.5

1078. HAMMOND, J. B. 634.511:575.42(42)
In search of better walnuts.
J. Minist. Agric. 1938 : **45** : 38–43.
As a result of a walnut competition held in 1929, five English walnut trees have been selected for vegetative propagation on the basis of the quality of their nuts as fresh walnuts. The prize winning trees in the classes for "double" nuts and dried walnuts and two trees producing nuts especially suitable for pickling have also been selected. The trees have been found satisfactory from the cultural point of view and are capable of self-pollination.
Wood of some 60 foreign varieties was collected and the resulting trees tested and the most successful were the four French varieties Franquette, Mayette, Meylanaise and Treyve.
Grafted and budded trees are now beginning to replace seedling trees.

1079. KUMAR, L. S. S. and
JOSHI, W. V. 634.58:575.242.061.6
A white-flowered type of *Arachis hypogaea* Lin.
Curr. Sci. 1938 : **6** : 454–55.
A single plant with white flowers occurred in 1934 among the orange-yellow flowered plants of the local variety of groundnut. By selfing, 16 plants were obtained from it, 14 with white flowers and 2 with orange yellow. On selfing all these plants bred true for flower colour. No explanation of this behaviour is given.

VEGETABLES 635

1080. 635.31-1.557:577.8
Some experiments in asparagus cultivation.
J.R. Hort. Soc. 1938 : **63** : 133–35.
In an experiment lasting five years the male plants have produced 57 per cent more saleable stems than the female plants.

1081. SARVAYYA, CH. V. 635.646:575.127.2
The first generation of an interspecific cross in Solanums, between *Solanum melongena* and *S. xanthocarpum*.
Madras Agric. J. 1936 : **24** : 139–42.

An account of the interspecific hybrid from the cross *S. xanthocarpum* x *S. melongena*; no success was obtained with the reciprocal cross. The hybrid is very vigorous and partially sterile, especially after open pollination or controlled self-pollination. Back-crosses with the two parents are fairly successful, using the hybrid as pistillate parent.

STATISTICS 519

1082. Bjerke, B. 519.24
Intraklassekorrelasjon. To synsmåter—én formel. (**Intraclass correlation. Two views—one formula**).
Meld. Norg. LandbrHøisk. 1937 : **17** : 496–502.
The author shews the formal mathematical identity of the intra-class correlation method of Harris with the analysis of variance method of Fisher, which deals with data arranged in a number of groups. J. W.

1083. Bliss, C. I. 519.24
The transformation of percentages for use in the analysis of variance.
Ohio J. Sci. 1938 : **38** : 9–12.
When experimental results are obtained as percentages, the error is a function of the number of individuals on which the percentage is based and also of the theoretical percentage which is sampled by the observed value. To obtain a valid, pooled estimate of the error it is therefore necessary to transform the percentages to a measure whose variance does not depend on the theoretical value. The transformation used is to the angle θ such that $p = \sin^2 \theta$ where p is the expected proportion of one type of individual. An abbreviated table is given for converting percentages into angles, with the fractions of a degree given in decimals instead of minutes and seconds; the full table will be published elsewhere.

1084. Bjerke, B. 519.24:631.421
Sammenregning av observasjonsrekker. (**Notes on the mathematical treatment of observations**).
Meld. Norg. LandbrHøisk. 1937 : **17** : 305–30.
The author provides mathematical proofs of the theorems at the basis of the analysis of variance methods appropriate to grouped data, including as special cases the methods of randomized blocks and the Latin square, in order to supplement the treatment given by Snedecor in his book, "Calculation and interpretation of analysis of variance and covariance" (Cf. "Plant Breeding Abstracts", Vol. IV, p. 354). J. W.

1085. Capó, B. G. 519.24:631.421
A comparative study of the statistical methods most commonly used in agricultural research.
J. Agric. Univ. P.R. 1937 : **21** : 201–24.
A short account is given of the principles underlying the use of the statistical methods commonly used in agricultural research. The methods described are Besset's method, Fisher's unrestricted method compared with Hayes' deviation from the mean method, Fisher's methods of randomized blocks and latin square, and "Student's" method for paired observations. Examples are given and tables provided for testing significance. J. W.

BREEDING 575

1086. Brown, H. B. 575:633
Contributions of plant breeding to an improved agriculture.
Proc. 37th Annu. Convent. Ass. S. Agric. Wkrs, Jackson, Miss., 1936 (1937) : 53–54. (Abst.)
The importance of co-operation is stressed in this general survey.

1087. Cook, M. T.,
Otero, J. I. and
López Domínguez, F. A. 575:633
History of the first quarter of a century of the Agricultural Experiment Station at Rio Piedras, Puerto Rico.
Bull. P.R. Agric. Exp. Sta. 1937 : No. 44 : Pp. 123.
The first 25 years of this station, formerly known as the Insular Experiment Station, were completed in June 1936. Plant breeding is one of the activities of the station.

Over 100,000 sugarcane seedlings have been raised, from which several promising varieties have been developed, including such disease-resistant, high yielding forms as P-R 803 and P-R 807. The initiative of the station in this matter has led growers to take up breeding, notably the Fajordo Sugar Company, which produced F-C 916 and F-C 1017.
Breeding a commercial filler type of tobacco resistant to mosaic was begun in 1931, using the Columbian variety Ambalema as resistant parent.
In eggplants breeding for resistance to bacterial wilt was begun in 1926 and led to the production of Puerto Rican Beauty, which is both resistant and superior in food qualities. A tomato variety tolerant to the same disease has been bred.
A resistant Chinese variety of cucumber has been used in breeding for resistance to downy mildew. The work is not yet completed.
Several high quality seedless oranges have been selected and propagated under the name "Rico oranges".
The improvement of Sea Island cotton by selection was started in 1931.
Breeding work is also in progress with maize and beans and varietal tests are conducted with horticultural plants both on the station and on the Isabela sub-station.

1088. 575:633(43.8)
MIECZYŃSKI, T. 63.00.15(43.8)
Zarys organizacji i działalności Państwowego Instytutu Naukowego Gospodarstwa Wiejskiego. (**Outline of the organization and activities of the State Institute of Agricultural Science**).
Bibljot. Puławsk. 1937 : No. 13 : Pp. 78.

An account is given of the activities of the Institute. The Department of Plant Breeding has carried out selection on rye, wheat, oats, barley, millet, lupin, forage plants and a number of legumes, as a result of which a series of improved varieties has been put on the market. These include Puława *durum* wheat which under conditions of good cultivation and not too excessive rainfall gives amber vitreous grain of the highest quality; Puława brewing barley with very much improved grain; and Puława millet, characterized by high yield and freedom from shedding. With the rise of private breeding firms this purely practical side has given place to more fundamental lines of research and to the breeding of lesser known crops such as soya bean, flax and strawberries; soya bean varieties with improved yield and better beans have been obtained, and improved forms of other leguminous crops such as peas, beans and vetches have been produced. The work of producing improved seed of forage plants is being extended. Tests of a number of new tobacco varieties have been made, as well as of a variety of other crops, including sweet lupins from Germany.
Crosses between different cereal genera have been made and are thought to be of interest from a practical point of view.
Experiments have shewn the method of vernalization to have little value for Polish conditions, lower yields having been obtained from vernalized sowings of rye, wheat and rape than from ordinary spring sowings.
Extensive investigations have been made on quality in wheat, rye, barley and oats.

1089. H. 575:633(48.5)
Methoden en resultaten van de afdeeling Celonderzoek in Svalöf. (**Methods and results obtained by the section for cytological research in Svalöf**).
Erfelijkheid in Praktijk, Leiden 1938 : **3** : 119–20.

An account of lectures given in Holland by Professor Müntzing of the Svalöf Plant Breeding Institute describing the work done there on wheat x rye hybrids, on the induction of chromosome doubling in pure lines and hybrids of barley by treatment with steam and with colchicine, on twinning (from which important results were obtained with timothy) and on degeneration due to inbreeding.

1090. 575:633(49.2)

Dertiende beschrijvende rassenlijst, opgemaakt ingevolge de beschikking van den Minister van Binnenlandsche Zaken en Landbouw van 21 October 1924. **(13th descriptive list of varieties, drawn up in pursuance of the Order of the Minister of Internal Affairs and Agriculture of the 21st October 1924).**
Inst. Plantenveredeling, Wageningen 1937 : Pp. 177.

Veertiende beschrijvende rassenlijst, opgemaakt ingevolge de beschikking van den Minister van Binnenlandsche Zaken en Landbouw van 21 October 1924, gewijzigd 28 Maart 1933. **(14th descriptive list of varieties, drawn up in pursuance of the Order of the Minister of Internal Affairs and Agriculture of the 21st October 1924, amended 28th March 1933).**
Inst. Plantenveredeling, Wageningen 1938 : Pp. 194.

This annual series of pamphlets is intended to keep the Dutch farmer informed of the varieties and strains available in Holland that have been officially approved by the Dutch Inspection Service (the N.A.K.), which judges and certifies only strains and varieties derived from "original" seed, i.e. seed supplied by the breeder. In addition to descriptions of the varieties, their origin and the breeder's address are given with an indication, where applicable, that the breeder is under the control of the N.A.K., which co-operates with the Dutch Plant Breeders' Association. Varieties are classed as: recommended or recommended for trial; new or insufficiently known; old land races; only certified for export; eliminated and no longer accepted for field inspection; included in French, German and English lists of varieties; accepted for inspection but not described, being unimportant.
The organization of the inspection work and co-operation of various official and other bodies therein is mentioned, with observations on the system adopted and its efficiency, which is further enhanced by the support and active co-operation of individual breeders and farmers. The large number of crops included in the list comprises cereals, roots, legumes and non-leguminous forage crops, grasses, flax and other economic plants; and data are given dealing with the time of sowing, winter-hardiness, development of the plant, yields, resistance to diseases, pests, lodging and shedding, soil requirements, etc.
Information on relevant legislation and official decrees is also provided, as well as statistical tables summarizing the area of distribution of various crops throughout the country.
In addition to the Dutch text, keys to the crops and translations of main headings and other data on the contents of the booklets are provided, either in French or English for the convenience of foreigners wishing to use the lists.

1091. Richey, F. D. 575:633(73)

Why plant research?
J. Amer. Soc. Agron. 1937 : **29** : 969–77.

Some of the successes of applied botanical research in North America are briefly surveyed, with special reference to plant breeding. The value of disease-resistant varieties of wheat, sugar beet, sugar cane, lettuce, cantaloupe and tomato is demonstrated. Improvements in quality and new crops are also mentioned.
The inference is drawn that continued research is needed for the future.

1092. Howard, W. L. 575:633:007

Luther Burbank.
Science 1938 : **87** : p. 139.

The writer appeals for the loan or gift of catalogues and price lists issued by Luther Burbank in connexion with an inquiry he is making into Burbank's work.

1093. 575:633:061.3
MEISTER, G. K. 63.00.15(47)
(Paper read at the 4th session of the Lenin Academy of Agricultural Sciences).
Sotsialističeskaja Rekonstruktsija Sel'skogo Khozjaistva (Socialist Reconstruction of Agriculture) 1937 : No. 2 : 12–26.

*VAVILOV, N. I.
(Soviet breeding methods).
Ibid. 1937 : No. 2 : 27–49.

LYSENKO, T. D.
(Paper read at the 4th session of the Lenin Academy of Agricultural Sciences).
Ibid. 1937 : No. 2 : 50–74.

MULLER, G.
(The present state of experimental data on the nature of the gene).
Ibid. 1937 : No. 2 : 75–95.

A reproduction of the papers read at the fourth session of the Lenin Academy of Agricultural Sciences in 1936, referred to in "Plant Breeding Abstracts", Vol. VIII, Abst. 65, with the speakers' replies to points raised in the discussion.

GENETICS 575.1

1094. KŘÍŽENECKÝ, J. 575.1
Význam J.G. Mendela pro zemědělské vědy. **(The importance of J.G. Mendel for agricultural sciences).**
Věstn. Čsl. Akad. Zeměd. 1938 : **14** : 25–29.

A lecture pointing out how Mendel's discoveries form the basis of scientific breeding work and their value in agricultural practice.

1095. MEUNISSIER, A. 575.1
Sur la vulgarisation des récents travaux concernant la génétique et enseignements d'ordre pratique à en tirer. **(On the popularization of recent work on genetics and the information of a practical kind to be drawn from it).**
Bull. Soc. Nat. Hort. Fr. 1937 : August : Pp. 14.

A brief review of the basic principles of genetics, simply and clearly expressed and their application in explanation of a number of phenomena of practical interest.

1096. 575.1
OEHLKERS, F. 575
Vererbung.
A. Allgemeine Vererbungslehre. B. Spezielle Vererbungslehre.
(Inheritance.
A. Genetics—general. B. Genetics—special).
Fortschr. Bot., Berl. 1937 : **6** : 288–306.

The review of general aspects of genetics includes the recent contributions to the problem of heterosis, genom analysis, the effect of the plasma and mutation. The other sections deal with more specialized problems relating to species and genera. For earlier reviews see "Plant Breeding Abstracts", Vol. VII, Abst. 81.

---

* An extended summary of this paper is on file at the Bureau.

1097. Rosinger, K. E. and
Rosinger, A. von P. 575.11
The number and Mendelian ratios of phenotypes and genotypes.
Quart. Rev. Biol. 1938 : **13** : 65–73.
Tables are given shewing the phenotypic and genotypic ratios obtained by the Mendelian segregation of increasing numbers of dominant, independent genes. Some mathematical relationships are demonstrated.

1098. Wilczyński, J. 575.11:519.24
Some new generalisations of genotypical formulae for Mendelian expectations.
Biol. Gen. 1938 : **14** : 47–54.
The author illustrates how Pascal's triangle of binomial coefficients may be used for the calculation of Mendelian genotypical expectations. J. W.

1099. Benl, G. 575.11.061.6:581.46:016
Die genetischen Grundlagen der Blütenfarben. (Sammelreferat). [**The genetical basis of flower colour. (Review of literature)**].
Z. indukt. Abstamm.-u. VererbLehre 1938 : **74** : 242–329.
The plants investigated are arranged in alphabetical order under their Latin names and the genetical results of researches on flower colour are given. The genes described can be divided into three main groups, basal factors, modifiers and localizors and a table is given shewing the distribution of these factors among the plants investigated.

1100. 575.12:575.148
*Dolgušin, D. A. 575.12:575.74
(Intravarietal crossing).
Novoe v Sel'skom Khozjaistve (What is new in agriculture) published by Sel'khozgiz, Moscow 1937 : No. 11 : Pp. 30.
The various types of mechanism found in nature for preventing self-pollination and ensuring cross-pollination are mentioned and Darwin is referred to as having categorically declared that self-pollination is invariably prejudicial and cross-fertilization always beneficial to the plant.
During the preceding generations, the author maintains, a plant becomes adapted to the environment in which it is grown; thus two different plants, though belonging to the same variety, will be different in the precise set of conditions to which they are adapted; and consequently a zygote produced by crossing these two will have a wider range of adaptability than either of the zygotes obtained by selfing the two varieties.
Experiments are described shewing that seed from intravarietal crossing gave higher yields; the germination was more regular, the young plants were more vigorous, the leaves darker coloured and wider, while the ear emergence was 1–2 days earlier. In order to carry out such crosses on a large scale, a simplified method of emasculation has been devised consisting in cutting through the anthers by cutting off the tips of the spikelets with a pair of short scissors, leaving the stigma untouched. It has even been decided that emasculation is not necessary at all, since if an aperture is made by removing the tip of the spikelet the anthers dehisce outside the spikelet; this, together with the greater receptivity of the plant to foreign pollen, which is readily accessible through the aperture, ensures that the majority of spikelets are out-pollinated. In experiments to test this only 17 per cent of self-pollination in wheat ears was observed and the new method has now superseded emasculation. From an 8-hour day's work as many as 15,000 grains can be produced, i.e. 0·5 kg. Having produced 10–15 kg. of crossed seed it is multiplied in wide spacing and in two years produces enough to sow 100–150 ha., and from each hectare not less than 1·5 tons will be produced. Instructions for the rapid multiplication of the seed are given.

---

* An extended summary of this paper is on file at the Bureau.

1101. 575.12:575.148
MALAKHOVSKII, A. 575.12:575.74
(On the biological characteristics of intraracial crossing).
Sotsialističeskaja Rekonstruktsija Sel'skogo Khozjaistva (Socialist Reconstruction of Agriculture) 1937 : No. 2 : 96–103.
The interpretation offered by geneticists for the phenomenon of heterosis is, it is maintained, inadequate in that it neglects the role of the protoplasm and data of various authors are cited to shew that the capacity for fertilization of sperms from the same individual is, both in animals and plants, less than that from different individuals, even in hermaphrodites. It is concluded that protoplasmic differences are responsible and reference is made to experiments of Morgan and of Lysenko, in which latter case a single sugar beet plant was separated and after growing the two halves in different conditions they were found to be capable of fertilizing each other.*
The author further maintains that a certain degree of heterozygosity is advantageous to any given race, in that it gives the potentiality for constant progress. No variety, it is pointed out, can be regarded as pure in the absolute sense and hence crossing different individuals within the variety is advantageous in respect both of the nuclear and cytoplasmic differences between individuals.

1102. FRANDSEN, K. J. 575.125
Heterosis. Bastardyppighed, krydsningsfrodighed. **(Heterosis. Hybrid vigour, crossability).**
Ugeskr. Landm. 1937 : **82** : 225–29.
A short account of the phenomena of heterosis including Jones' theory in explanation and some of the results of a practical application of heterosis both for plants and animals.

1103. ALLAN, H. H. 575.127.2
Wild species-hybrids in the Phanerogams.
Bot. Rev. 1937 : **3** : 593–615.
A survey of the literature with a bibliography of 106 references.

1104. VAKHRUŠEV, E. T. 575.148:575.114:633.11
(The biological variation of a pure line).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : No. 7 : 22–25.
Evidence is presented to prove that segregation occurs in a number of wheat varieties (referred to rather paradoxically as pure lines) and the consequent measures required to maintain purity during seed production are indicated.

1105. †KHITRINSKII, V. F. 575.148:575.12
(Intravarietal crossing).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : No. 6 : 15–18.
A further contribution to the question of crossing within a variety and the production of new varieties in 18 months. T. D. Lysenko has argued that plants of a variety, say Ukrainka, grown in Odessa for a number of years will be different ecologically from plants of the same variety grown, say, in Kiev, although the differences will not necessarily be detectable by the eye and each group of plants will unquestionably belong to the variety Ukrainka. By intercrossing such plants a progeny will be obtained that excels both parental strains in vigour, yield and adaptability. Such crosses were made in 1935. The seeds from the crosses were sown in the greenhouse in December and produced grain in the following spring, March 1936. These grains were sown in the open along with the parent varieties. The results, some of which are tabulated, indicate that the hybrids germinated sooner, developed better,

* No control is mentioned however.—Abstractor's note.

† An extended summary of this paper is on file at the Bureau.

were larger, produced a greater weight of vegetative matter and eared 1–2 days sooner than the parental controls; certain crosses gave rather better results than others. The hybrids shewed moreover no signs of segregation and are thus referred to as a new variety.

1106. Ernst, A. 575.17:575.24
Vererbung durch labile Gene. (**Inheritance by labile genes**).
Verh. schweiz. naturf. Ges. 1936 : 186–207.
Contains an account of the author's investigations on calycanthemy in *Primula*. This character, involving modification of calyx segments into petals, is inherited as a Mendelian dominant, but in some strains frequent back-mutations to the normal condition occur, both generatively and somatically. The dominant gene is therefore labile.
The author suggests that labile mutations represent unstable chemical rearrangements within the gene, in distinction to stable mutations, which he conceives as due to losses of parts of the gene molecule.
The significance of labile mutations for human genetics is discussed.

1107. Platikanov, N. 575.17:581.143.26.03
(**The foundations of modern genetics are questioned**).
Zemledelie, Sofia 1937 : **41** : 117–20.
A brief outline is given of established genetical theory, followed by an account of the work of Lysenko and collaborators in Russia. This work, it is pointed out, requires verification, firstly on account of the very small number of experimental plants (two in the case of the "transmutation" of Kooperatorka) and secondly because of the introduction of a new principle —phasic development—said to influence the hereditary nature of the plant. It is expected that such a verification will confirm the general genetical theory but some part of it, such as the stability of the gene, may be found to require modification.

1108. Sirks, M. J. 575.182
Plasmatic inheritance.
Bot. Rev. 1938 : **4** : 113–31.
A survey of the literature on the part played by the cytoplasm in inheritance.

1109. Kostoff, D. 575.243:576.356:578.088.2
The effect of centrifuging upon the germinated seeds from various plants.
Cytologia, Tokyo 1938 : **8** : 420–42.
The results of centrifuging seedlings of *Nicotiana Langsdorffii*, F_1 *N. rustica* x *N. Tabacum*, *Vicia Faba*, *Crepis capillaris* and *Pisum sativum* are reported. The treatment was most frequently carried out at 2500 to 3500 r.p.m. and was spread over three or four days, 2 to 3 hours centrifuging being given each day in doses of 15–30 minutes.
The chromosomal alterations produced were both structural and numerical, the latter including aneuploidy as well as polyploidy. An amphidiploid was produced from the F_1 hybrid; it did not breed true, owing to the formation of trivalents and quadrivalents at meiosis.
The progeny of a centrifuged *N. Langsdorffii* plant included a semi-sterile plant and a variegated one. The variegation was inherited maternally (Cf. also "Plant Breeding Abstracts", Vol. VIII, Abst. 411).

1110. 575.257
Winkler, H. 575.255
Über einen Burdonen von *Solanum Lycopersicum* und *Solanum nigrum*.
(**On a burdo of *S. Lycopersicum* and *S. nigrum***).
Planta 1938 : **27** : 680–707.
In "Plant Breeding Abstracts", Vol. IV, Abst. 1019 and Vol. VI, Abst. 447 the author's definition of the term "burdo" is reviewed and the occurrence of two plants from a graft of *S. nigrum* and *S. Lycopersicum* with "burdo" epidermis are noted. From one of these a shoot was produced in which both epidermis and sub-epidermis were burdo and from this in turn a plant was produced that was burdo throughout. These two plants are described in detail. As was to be expected, the complete burdo was sterile.

1111. Daniel, L. 575.31:635.24
Sur un cas indiscutable d'hérédité de caractère acquis. (**On an indisputable case of the inheritance of an acquired character**).
C.R. Acad. Sci. Paris 1938 : **206** : 872–74.
Every year since 1894 the author has grafted the Jerusalem artichoke on to the annual sunflower, until 1921 without result. In that year the artichoke produced seeds and swollen roots were produced on the sunflower. An examination of the roots shewed that they in fact belonged to the artichoke and had penetrated the tissue of the stock. It appears that such roots have never before been found on the species of artichoke used. From seeds of the plant sown in the following year occurred, in the 5th generation, plants with swollen roots, and which when vegetatively propagated retain this property. The inheritance of the acquired character is held to be proved.

ORIGIN OF SPECIES, ETC., 576.16

1112. Rohweder, H. 576.16:576.312.32:576.356.5
Das Artbildungsproblem im Lichte der Chromosomenforschung. (**The problem of species formation in the light of chromosome research**).
Umschau 1938 : **42** : 191–93.
A general review of the significance of the chromosomes in species formation with special reference to polyploidy.

CYTOLOGY 576.3

1113. Gates, R. R. 576.312.315
The discovery of the relation between the nucleolus and the chromosomes.
Cytologia, Tokyo 1937 : Fujii Jubilee Vol. : 977–86.
The historical development of the theory relating nucleoli to the satellite chromosomes is traced. The author suggests that there are two kinds of satellites, those in connexion with which the nucleolus arises and those which take no direct part in nucleolus formation. When an organism has more than one pair of the first type it is probably due to polyploidy. It is possible that subterminal centromeres have been mistaken sometimes for satellites of the second type.

1114. Heyn, A. N. J. 576.312.35
Chromosome numbers of some cultivated plants of the Netherlands East Indies.
Chronica Botanica 1938 : **4** : p. 107.
The following chromosome numbers are given, presumably all somatic numbers: *Oryza sativa* and *O. Meyeriana* (32 varieties), 24; kapok, *Ceiba pentandra* var. *Suriname* 88, var. *Congo* 88, var. *Saigon* 72, var. *Bondowoso* 72, var. *Kelet*,72, var. *Boeboelak* 80, var. *Lanang* 284; *Coffea liberica* 44, *C. excelsa* 22, *C. Abeokutae* 22, *C. canephora* 22, *C. robusta* 22, *C. congensis* 22, *Kawisari* D coffee 44, *Kawisari* B 33 and 44; *Derris malaccensis* 22; *D. elliptica* 20; gutta-percha, *Palaquium Gutta* 24.

1115. 576.312.35:581.143.26
Stebbins, G. L. 576.312.34:581.143.26
Cytological characteristics associated with the different growth habits in the dicotyledons.
Amer. J. Bot. 1938 : **25** : 189–98.
From a study based on chromosome lists the author finds that woody genera have higher basic numbers and less variation in basic number within a genus than have herbaceous genera. Polyploidy is most frequent in strictly perennial herbaceous genera and less frequent in the strictly annual and the woody groups. The great majority of woody genera have small chromosomes while larger chromosomes are relatively frequent among herbaceous genera and those containing both woody and herbaceous species.

1116. Eigsti, O. J. 576.356.5:581.04
A cytological study of colchicine effects in the induction of polyploidy in plants.
Proc. Nat. Acad. Sci. Wash. 1938 : **24** : 56–63.
The author studied the effect of colchicine on the root tips of onion and on seedlings of maize, radish and wheat. Concentrations of 0·01 per cent and 0·1 per cent produced the swellings and other characteristic morphological reactions to colchicine while 1 per cent was toxic. In *Allium* tetraploid, hexaploid and octaploid nuclei were obtained and tetraploidy was noted in maize. More prolonged treatment produced other cytological abnormalities characteristic of injurious agents in general.

1117. Walker, R. I. 576.356.5:581.04
The effect of colchicine on microspore mother cells and microspores of *Tradescantia paludosa*.
Amer. J. Bot. 1938 : **25** : 280–85.
The production of diploid and tetraploid pollen grains as a result of colchicine treatment is described. Octaploid and hexaploid pollen grains were occasionally found. The drug is considered to act on the spindle mechanism.

1118. Turesson, G. 576.356.5:581.9
Chromosome stability in Linnean species.
Ann. Agric. Coll. Sweden 1938 : **5** : 405–16.
A study of the chromosome numbers of a number of wild plants from very different habitats and climates has shewn that there exists a remarkable stability in the chromosome number within a Linnean species. Of the thirty species examined only five shewed variation in chromosome number and the data fail to support the suggestions of Hagerup (Cf. "Plant Breeding Abstracts", Vol. IV, Abst. 253) and Tischler (Cf. "Plant Breeding Abstracts", Vol. V, Abst. 922) that polyploidy represents the reaction of the species to severe climatic conditions.

BOTANY 58

1119. Savitskii, M. S. 581.143.26.03
(Achievements of the Odessa Institute of Genetics and Breeding shown at the State Agricultural Exhibition).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : No. 5 : 19–22.
A condensed outline is given of Lysenko's theories of phasic development; choice of parental pairs and the selection of the progeny in the first hybrid generation; the production of hardy varieties by vernalization followed by autumn sowing; intraracial crossing for the increase of adaptability, quality, hardiness and yield; the summer planting of potatoes to prevent degeneration; the method of cutting off the top of the cotton plant and the monopodial branches, whereby maturity is hastened and yield increased; and the principle of the alteration of the genotype by environmental influence.

1120. Bremer, A. H. 581.143.26.035.1:635.34
Chinesischer Kohl oder Selleriekohl (*Brassica pekinensis* Rub.), eine Langtagspflanze. II. **Chinese cabbage (*B. pekinensis* Rub.), a long day plant. II).**
Gartenbauwiss. 1938 : **11** : 473–82.
Previous work in 1934 shewed that *B. pekinensis* is a long day plant which is not sensitive to heat and drought, if grown only under conditions of reduced length of day.
Twelve lines were isolated from the varieties Pe-Tsai, Wong Bok and Chihli (which were probably heterogeneous populations) and with the F_1 from 9 crosses between early and late lines of Pe-Tsai were grown under long and short day conditions in 1935; while in 1936 a selection of isolated lines and F_2 plants after crossing were similarly tested. The results shewed that selection in self-pollinated plants is effective in determining the tendency of the

line towards early or late bolting. The F_1 from a cross of early x late gave average variation under long and short day, while the F_2 shewed greater tendency to vary.
The paper concludes with observations on cultivation and descriptions of 9 varieties, Pe-Tsai, Amélioré, Wong Bok, Senjyu, Chihli, Nobori, Cantonner, New Joy and Hakusai-hoo, including notes on the time at which bolting occurs.

FIELD TESTS 631.421

1121. Forester, H. C. 631.421
Design of agronomic experiments for plots differentiated in fertility by past treatments.
Res. Bull. Ia Agric. Exp. Sta. 1937 : No. 226 : 141–72.
The possible methods of utilizing for new experiments acres of land which have been differentially treated in past experiments are examined, and methods of design are tested utilizing yields from a field which formed part of a rotation and fertilizer experiment conducted since 1915. Reduction of the error was attempted (*a*) by grouping plots from different parts of the field on the basis of equal fertility to form the block of the new trial, and (*b*) by the application of covariance analysis to blocks formed by the grouping of adjacent plots, the independent variable being the results of the previous trial on those plots. It is concluded that the latter method is the more satisfactory, and it has the advantage that the covariance adjustment supplies its own test of efficiency in reducing the error variances. J. W.

1122. Barbacki, S. 631.421:519.24
Ogólna metodyka doświadczeń polowych w zarysie. (**An outline of the common methods of field investigation**).
Bibl. Puławska 1935 : No. 12 : Pp. 119.
An outline is given for Polish readers of the chief methods of field experimentation evolved in England and Poland, with examples of their application.

1123. Opsomer, J. E. 631.421:519.24
Notes techniques sur la conduite des essais avec plantes annuelles et l'analyse des résultats. (**Technical notes on the performance of trials with annual plants and the analysis of the results**).
Publ. Inst. Agron. Congo Belge 1937 : Sér. Sci. No. 14 : Pp. 79.
After a brief introduction to the normal distribution and its parameters, the classical methods of field experimentation are shortly described. The methods introduced by Fisher are then described; the principle of randomization is emphasized and an account is given of the analysis of variance. Examples of randomized block and Latin square trials are worked out and an example is also given of a combined trial. There follows practical notes on the performance of trials. A bibliography of 47 references is given.
Appendix I gives detailed instructions for carrying out local trials with food plants in the Belgian Congo and Appendix II gives Snedecor's table of "F" and Fisher's table of "*t*".

1124. Vries, O. de 631.421:519.24
Het serieprincipe bij veldproeven. (**The "scale-principle" for field trials**).
Landbouwk. Tijdschr. Wageningen 1938 : **50** : 340–58.
An outline is given of a method of analysing data accruing from field trials. The method is called the "serie principe" and is a graphical method akin to the well-known statistical device of a curvilinear (or multiple) regression. Technical details of the method (which is admittedly subjective) have recently been described (Cf. "Plant Breeding Abstracts", Vol. VIII, Abst. 781) and are here illustrated with examples: the procedure may be regarded as a graphical equivalent to using a best estimate of a regression for a correction.

The method is then applied to various problems in field experimentation, which could be (and in some cases have been) treated more accurately by a regression analysis.
In the first place it is used to plot corrected yields of experimental wheat plots against the corresponding levels of a certain N-manure which had been applied to the plots. The comparative response to this manure of different varieties and the respective most favourable rates of application can be judged from the graph. A corresponding graph for an experiment on P-manures gives a comparison of yields obtained on different types of manure but on the same level of P_2O_5. Differences between the main responses to the manures are judged by an inspection of the graph. Quite apart from the uncertainty in the significance of such a test it is obvious (and explicitly stated) that this method can only be applied to experiments in which all treatments may be represented by different levels on the same scale (e.g. levels of P_2O_5 in different types of P-manures).
In the second place the method is used to establish local control through concomitant measurements, such as the determination of the *p*H in different plots or the respective average values of the "P-getal". (This latter figure is a measure of the presence of phosphoric acid in the soil and is used in Dutch investigations dealing with P-manures).
Finally the method is generalized so as to cover the case of several plant- or soil-attributes occurring simultaneously. H. O. H.

1125. Ting, Y. and
Sie, H. T. 631.421:633.18
(The field technique of the experimental method and its error in rice.)
J. Agric. Ass. China. 1935 : No. 142–143 : 13–48.

This experiment was carried out in 1933 with an early and a late variety. A 15 Chinese-foot (= 5 meters) row was found to be best for a single-row plot. As to the size of plots, it was found that plots of four 15-foot rows gave the maximum reduction of error, and a further increase in the number of rows shewed no significant gain. No significant difference was found between plots of different shapes (e.g., between four 15-foot rows and plots of three 20-foot rows, etc.), provided they were of the same area. In addition the authors suggested that in order to avoid natural crossing in varietal comparison tests shorter and wider plots were preferable.
As to the insertion of control plots, no significant differences were found between the individual control plots inserted at intervals so that every *n*th plot is a control, *n* ranging from 3 to 10. Since the field used for this test was rather uniform, Student's direct comparison method gave results similar to the gradation method, and therefore theoretically both methods could be equally recommended; but according to the authors, Student's method seemed to be more practical and convenient when the test is made on uniform fields.
A comparison was made between systematic arrangement and randomized arrangement of plots (both Randomized Blocks and the Latin Square). Only insignificant reduction of error was obtained: error reduced from 1·43 per cent for systematic arrangement to 1·16 per cent for Latin Square and from 1·42 per cent to 1·33 per cent for Randomized Blocks. The authors thus concluded that Randomization was not indispensable for rice experimentations. T. C. C.

PLANT DISEASES 632

1126. Reddick, D. and
Mills, W. 632.411.4–1.521.6:633.491
Building up virulence in *Phytophthora infestans*.
Amer. Potato J. 1938 : **15** : 29–34.

By repeated passage through resistant varieties of potato the virulence of a culture of *P. infestans* can be increased to a point where hybrid potato strains which normally are resistant give a susceptible reaction. There still remain, however, hybrids which give no reaction whatever when inoculated with cultures of any virulence. It may be, therefore, that complete immunity rather than partial resistance is necessary for practical purposes.

1127. Utter, L. G. 632.451.2:575.127.2:576.16
Culture and inoculation studies on races of the loose and covered smuts of oats.
Amer. J. Bot. 1938 : **25** : 198–210.
The cultural characteristics of isolations of loose smut (*Ustilago avenae*) and covered smut (*U. levis*) of oats were found to be too inconstant to permit of their use in identifying physiological races.
Two crosses between race I of *U. avenae* and race I of *U. levis* were made by inoculating oats with paired monosporidial cultures and in the F_2 and later generations of this cross recombination of parental characters occurred, giving rise to new physiological races.

1128. Köhler, E. 632.8:575.24
"Mutationen" bei pflanzenpathogenen Viren. (Sammelreferat). [**"Mutations" in plant pathogen viruses. (Collected bibliography)**].
Züchter 1938 : **10** : 68–72.
The literature on the so-called mutations in plant viruses is reviewed. While there is no doubt that changes occur both in the degree of virulence and in the symptoms shewn by the host plant, the actual nature of these variations has yet to be determined. It is probable that changes in the complex protein molecule are involved and in as far as the chromosome is also a complex protein structure there is a possible analogy between gene mutation and that shewn by some of the plant viruses.

1129. Gnadinger, C. B.,
Evans, L. E. and
Corl, C. S. 632.951.1:575.42
Pyrethrum plant investigations in Colorado. II. A review of the progress since 1932.
Bull. Colo. Agric. Exp. Sta. 1936 : No. 428 : 1–29.
Inter alia, data are given on selection work with pyrethrum (*Chrysanthemum cinerariaefolium*). Selecting seed from mother-plants with a high pyrethrin content has been found to produce a slight increase in pyrethrin content in the progeny over the parent stock.
Studies on self-fertilization are in progress. Tests of 25 strains from various sources did not shew any outstanding strains or individuals.

1130. Sievers, A. F. *et al.* 632.951.1–1.524.4:575(73)
Studies on the possibilities of Devil's Shoestring (*Tephrosia virginiana*) and other native species of *Tephrosia* as commercial sources of insecticides).
Tech. Bull. U.S. Dep. Agric. 1938 : No. 595 : Pp. 40.
Tephrosia virginiana is the commonest species of *Tephrosia* in the U.S.A., and extends from the New England states to Minnesota and south to Florida and Texas. The principal areas in which forms with insecticidal properties occur lie in northeast Texas, northeast Florida and southwest Georgia. There is some evidence that toxicity is an inherited character, though it may be strongly influenced by environment. The breeding of more toxic strains is part of the work planned. *T. latidens* is the only other species of immediate interest as an insecticide.

ECONOMIC PLANTS 633

1131. Voss, J. 633:578.082
Erfahrungen mit der Anzucht landwirtschaftlicher Kulturpflanzen im Treibhaus. (**Experiences in the raising of agricultural plants in the hot house**).
Züchter 1938 : **10** : 95–100.
Notes on practical experiences when growing plants under conditions of increased light and temperature as well as observations on the special requirements and reactions of certain crop plants.

1132. Deržavin, A. I. 633:581.143.26:575.127
(Perennial varieties of cultivated plants).
Novoe v Sel'skom Khozjaistve (What is new in agriculture) published by Sel'khozgiz, Moscow 1937 : No. 4 : Pp. 44.

The advantages of the perennial types which are found in related species of so many of the main crop plants are enumerated, these being largely associated with their greater vigour and yield, hardiness, disease and drought resistance and their considerably earlier maturity in the second and later years of vegetation; it is thus often possible to get more than one crop per year.

In crossing wheat with perennial rye the best results have been obtained with ryes from Armenia—the hybrids from these forms were more fertile and gave a more fertile back-cross progeny than any others; this is ascribed to the fact that these forms have for thousands of years been growing in similar climatic conditions to the wheats, as a result of which "their chromatin has become more similar", owing to natural selection of a similar ecological type. Wheat is also being crossed extensively with *Agropyrum* and with perennial rye. Of the latter over 200 different parental combinations have been made, in which an average success of 70 per cent was observed.

The most successful of all the combinations was *leucurum* 1364,1 x *Secale montanum* (Kat. 8) from Armenia which cross was made in 1933 and has now produced a fertile perennial *T. durum*, in which the yield and grain weight were superior to those of the standard varieties but the ear is unfortunately brittle. Hybrids of this form with standard wheat varieties have a tough rachis and it is thought probable that perennial tough forms will be obtained in the second or third generation. The hybrids are resistant to brown rust and quite immune to stem and yellow rust. New stems are formed after harvest and in 1936 these attained a height of 40–50 cm. and were cut for hay, and in 10–15 of the hybrids they produced a second crop of grain 50–60 per cent the size of the first, 15 to 24 grains being produced per ear, with a 1,000-corn weight of 35 grm. By suitable cultural treatments this second yield could be brought up to that of the first.

Similar crosses are being made between perennial and cultivated rye, sunflower with *Helianthus maximiliani* and *H. rigidus* and cultivated sorghum with *S. halepense* and several perennial leguminous species are being crossed with the allied cultivated forms.

1133. Wellhausen, E. J. 633–2–1.521.6:575
Breeding for disease resistance.
Trans. Ia Hort. Soc. 1935 : **70** : 99–105.

The topics discussed in this brief, general account include the genetic variability of host and parasite, non-parasitic diseases and the nature and inheritance of resistance.

1134. Keuchenius, A. A. M. N. 633.0015(92.1)
Overzicht van de ondernemingscultures in het Rayon West-Sumatra gedurende 1937. **(Survey of the crops grown on estates in the District of West Sumatra during 1937).**
Bergcultures 1938 : **12** : 268–75.

This report deals mainly with the economic situation, weather conditions and cultivation in relation to cinchona, coffee, rubber, tea and oil palm.

Manuring trials have been planned with cinchona to study any possible differences in the reactions of various clones. Stripe canker was particularly prevalent in buddings of Tjin I and in succirubra seed plots.

In order to meet the difficulties of obtaining adequate labour when required for work in the coffee plantations trials have been begun with plantings of S.A.24 x B.P.42, S.A.34 x B.P.42 and S.A.34 x B.P.56, all hybrid strains which produce late planting material with a good yield and large beans. Grafts of B.P.42, a late flowering clone with large beans, and of Moemboel 3·94, an early flowering clone, are also being used for the same purpose. Plantations have been maintained at a high level by replacing poor plants by vigorous, selected material and other cultural measures.

In 1937 about 26,000 rubber plants were laid down, including about 11,000 seedlings from hybrid strains and about 6,000 buddings.
Buddings of tea obtained in 1935 from Java and planted on about six estates have proved remarkably bad, though only a small proportion died. The area under oil palm was 1,100 hectares in 1937; the oldest plantations have not yet come into bearing.

CEREALS 633.1

1135. Quisenberry, K. S. 633.1:575(78.2)
Breeding small grains to fit your need.
Rep. Neb. Bd Agric. 1937 : 261–69.
A popular account of cereal breeding.

1136. Rubtsov, V. 633.1:575"793":575.22:581.02
(**Variability of winter cereals under natural conditions**).
Sotsialističeskaja Rekonstruktsija Sel'skogo Khozjaistva (Socialist Reconstruction of Agriculture) 1937 : No. 8 : 189–90.
The effect of unusual environment due to sowing winter forms of wheat and rye in spring revealed undesirable characters of the latter. The changes observed were more marked when seed from a distant locality was sown. The instance is regarded as a further demonstration of the theory of Lysenko and others of the action of environment on the genotype. The method could be used to hasten natural selection.

WHEAT 633.11

1137. Barbacki, S.,
Lewicki, S.,
Miczyński, K. (Jr.) and
Słaboński, A. 633.11(43.8)
Systematik der polnischen Weizensorten. (**Systematics of Polish wheat varieties**).
Angew. Bot. 1937 : **19** : 573–79.
This paper indicates the scope of the complete work, published in Polish, under the title "Pszenice Polskie." (See "Plant Breeding Abstracts", Vol. VIII, Abst. 797).

1138. Journée, C. and 633.11:575
Larose, E. 633.11 Hybride du Jubilé
Un nouveau froment obtenu à la Station de Recherches pour l'Amélioration des Plantes à Gembloux. L' "Hybride du Jubilé". (**A new variety of wheat obtained by the Plant-breeding Station at Gembloux. "Hybride du Jubilé"**).
Bull. Inst. Agron. Gembloux 1937 : **6** : 137–48.

Larose, E.
Un nouveau froment obtenu à la Station de recherches pour l'amélioration des plantes, à Gembloux. "L'Hybride du Jubilé". (**A new variety of wheat obtained by the Plant-breeding Station at Gembloux. "L'Hybride du Jubilé"**).
Ann. Gembl. 1938 : **44** : 55–57.
A new variety of wheat from the cross Hybride 23 de Vilmorin x Pansar III is described. It has shorter straw and is earlier than the shorter-strawed and earlier parent respectively. It is immune to smut and very resistant to cold, lodging and yellow rust. Variety tests, both at Gembloux and abroad have established its reputation as a high-yielding variety.

1139. Schribaux [and] Serin. 633.11:575
Deux nouvelles variétés de blé pour le sud-ouest. (**Two new varieties of wheat for the south-west**).
C.R. Acad. Agric. Fr. 1938 : **24** : 346–52.
Bladette du Sud-Ouest is from the cross Inversable x Besplas and is suitable for average soils. It has a white ear, brown grain, is resistant to drought, lodging and rust. Its baking quality is good.
Bladette de la Garonne from the cross (Alliés x Bon Fermier) x Préparateur Etienne is suitable for rich soils. It is as productive as Préparateur Etienne but is hardier and more resistant to drought and lodging.

1140. Prutskova, M. S. 633.11:575(47)
(**Varieties of winter wheat**).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : No. 5 : 39–44.
A report is given of observations made on wheat varieties in the course of the variety testing work. Reference is made to certain varieties that proved resistant to brown rust, others to stem rust and some to yellow rust; to varieties of improved productivity, including the wheat-rye hybrid 46/131. The superiority in many respects of the local wheats is pointed out and breeders are urged to give more attention to the improvement of these wheats.

1141. Pudkov, A. N. 633.11:575(47)
(**A new variety of spring wheat for Narym**).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : No. 5 : p. 62.
In tests of 2,000 varieties of wheat in northern conditions the new variety Severjanka gave particularly good results; it ripened in 102 days and produced 31 centners of large grain per hectare, as compared with 104 days and 23 centners for Garnet. Its yield was three times that of the local wheats and its grain much larger.

1142. Savič-Stroganova, I. G. 633.11:575(47)
(**The far Eastern "Banatka"**).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : No. 6 : 23–26.
Reference is made to a wheat variety known by the name "Strube" or "Selected Strube", which is said, however, to be not an imported German variety, but a strain produced by A. B. Černyševa by mixing together the best lines selected from the Ussurian district. It is thought that the original form consisted mainly of the rust-resistant Hungarian variety Banatka and the name "Far Eastern Banatka" is suggested as a substitute for "Strube". It still consists of a number of different morphological types, which are described; it maintains, however, its unusual resistance to rust and *Fusarium*, its standing capacity, excellent grain quality and adaptation to the ecological conditions of the far eastern zones of the U.S.S.R.

1143. 633.11:575(47.1)
Pesola, V. A. 633.11 Sopu
Sopu- vårvetet och dess närmaste medtävlare. (**Sopu spring wheat and its nearest competitors**).
Tidskr. Landtm. 1938 : No. 4 : 65–73.
The spring wheat Sopu originated from a cross made in 1928 between Marquis and the Finnish spring wheat Brunt. The results of variety tests in various parts of Finland are recorded.

1144. Sherbakoff, C. D. 633.11:575(76.8)
Wheat breeding at the University of Tennessee Agricultural Experiment Station.
Proc. 38th Annu. Convent. Ass. S. Agric. Wkrs, Jackson, Miss., 1937 : p. 312. (Abst.)
The main work has consisted in the breeding of disease-resistant varieties by hybridization and selection.

1145. Parker, J. H. 633.11:575(78.1)
Wheat improvement in Kansas, 1874-1934, with special reference to quality.
29th Bienn. Rep. Kans. Bd. Agric. 1933–34 : **34** : 139–64.
The origin and characteristics of the following wheats are described: Turkey, Kharkov, Kanred, Blackhull, Beardless Blackhull (Kanhull), Beardless Superhard (Chiefkam), Early Blackhull, Clarkam, Jones Winter Fife (Burbank), Kruse, Red Hull, Kooperatorka, Tenmarq and Kawvale.
Tenmarq has been crossed with the bunt-resistant Oro to produce a wheat similar to Tenmarq and bunt-resistant; it has also been crossed with Kawvale to introduce the resistance to Hessian fly of the latter.
The early Nebraska wheat Neb. 28 (from Big Frame x Turkey) was crossed with Kanred in the hope of combining the earliness of the former with the winter-hardiness of the latter, but without success. From a cross between Prelude and Kanred, however, the early variety Quivira has been bred. It yields well, has stiffer straw than Kanred, is as winter-hardy as Blackhull and is highly resistant to red leaf rust. Its grain shatters when fully ripe and its flour is rather yellow. It has not yet been approved for increase and distribution. Hybrids of Kanred x Hard Federation are being used in the hope of introducing the earliness, drought resistance and short stiff straw of the latter into hard red winter wheat, with some promise of success.
The author concludes with some remarks on the need for avoiding a multiplicity of varieties, for co-operation in wheat improvement and for some measure of control of varieties of wheat, the Canadian and Argentine systems being given as examples.

1146. Kulešov, N. N. 633.11:575"793"
(Spring wheat in the Tulun Station).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : No. 6 : 35–38.
The Siberian wheats are characterized by a longer period from germination to earing and a shorter period from earing to maturity, the varieties with the highest yield having a period from germination to earing of 46 to 48 days and varieties with a shorter period than this are lower in yield. Early maturity, which is necessary owing to the short growing season in Siberia, should be attained therefore by a reduction of the period from earing to wax ripeness, which should not be more than 40 days, giving a variety maturing in 88 days from germination or about 102 to 104 days from sowing.

1147. Pisarev, V. 633.11:575"793"
(The wheat Severjanka).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : No. 7 : 26–27.
The variety Severjanka was produced from a cross of Marquis x the early Siberian wheat Tulun 85; a plant of the Marquis type but equal to Tulun 85 in earlinesss was discovered in the F_3. In the later generations segregation was observed even up to the ninth and tenth generations and the most desirable types were selected. One of the earliest and best selections was named Severjanka. In the Leningrad zone it has proved earlier than Garnet and has given much higher yields.

1148. MILAN, A. 633.11:575.12:581.48:575.11.061.6
Esperimenti con acido fenico su cariossidi di grano pure ed ibride. (Experiments with phenol on the grains of pure varieties of wheat and hybrids).
Nuovo G. Bot. Ital. 1936 : **43** : 207–21.

The grain of certain wheat varieties when treated with phenol turn brown, in others the colour remains more or less normal. A number of crosses were made and it was noticed that the reaction of the grain was always that of the maternal parent. The grain from the F_1 plants of both direct and reciprocal crosses was always coloured. From the data available it seems probable that the character is inherited on mendelian lines.
Grains five years old gave the same reaction and it is suggested that the method is suitable for testing the stability of hybrid progeny.

1149. KIHARA, H. 633.11:575.127:576.312
(Knowledge of cytology of hybrids necessary for breeding).
J. Sug. Cane Res. Ass. Formosa 1937 : **15** : 1–10.

The lecturer found the diploid chromosome numbers of the varieties of sugar cane P.O.J.2725 and 2878 to be 107 and 119 respectively.
On discussing the significance of cytology in explaining sterility and fertility in interspecific and intergeneric hybrids examples were drawn from the following crosses:—*Triticum aegilopoides* x *Aegilops squarrosa*, *T. polonicum* x *Haynaldia villosa* (and the reciprocal) and *Avena barbata* x *A. strigosa*, the results of which have been reviewed from time to time in "Plant Breeding Abstracts", as has also inheritance in trisomic wheat plants, and the value of trisomics as an ultimate means of correlating disease resistance and morphological characters in studying linkage. The possibilities of utilizing crossing-over between non-homologous genoms, as exemplified in the *H. villosa* x *T. polonicum* hybrid, to introduce earliness into crosses from weeds or distantly related plants are indicated, and the breeder's attention is drawn to the method of obtaining polyploids by heat-treatment and to the need for careful selection of material with suitable combination of chromosomes where the production of higher orders of polyploidy is desired.

1150. SAPEHIN, A. A. 633.11:575.127.2
(Two new varieties of spring wheat for steppe regions).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : No. 7 : 25–26.

The production of two new varieties named Od.–03 and Od.–04, produced from a cross between *T. vulgare* (Girka 00274) and *T. durum* (Černouska 00122) is described. There were three times as many segregates of the *durum* type in the F_2 when soft wheat was used as the maternal parent and seven times as many with *T. durum* as maternal parent. A study of the inheritance of a large number of characters shewed that very few of them gave normal Mendelian ratios and the ratios were often quite different in the soft group from those in the hard group of segregates. There were, moreover, many more homozygous plants in the F_2 than would be expected judging from the heterozygous nature of the F_1. The reasons adduced are the differential growth rate of pollen with different chromosome numbers and the selective pairing of certain chromosomes.
The two new varieties produced from the cross are resistant to Hessian fly and are superior to both parents and to the local standards in yield, resistance to drought, smuts and shedding.

1151. YAMASHITA, K. 633.11:575.127.2:576.356.4
[Inheritance of pentaploid wheat hybrid, with special reference to trisomic plants. (Preliminary communication II)].
Jap. J. Genet. 1937 : **13** : 229–32.

Continuing the study of the trisomic plants derived from the cross *T. polonicum* (AABB) x *T. Spelta* (AABBDD), reviewed in "Plant Breeding Abstracts", Vol. VIII, Abst. 106, the writer found a gene in the d_2 lines which was an inhibitor of pubescence on the rachis and another gene reducing the density of the spike.

Trisomics bearing d_1, d_2 and d_4 on being crossed with *T. polonicum* and *T. dicoccum* gave trisomics with exactly the same characters as the d_1, d_2 and d_4 lines respectively.
In plants of Pedigree 1937–46 with 2n chromosomes the density of the ear was high and the glumes were sharply serrated, but in plants with 2n + 1 the reverse conditions were found. Such quantitative characters must be conditioned by numerous genes. In Pedigrees 1937–1, 2 serrations were sharp in 2n plants but not in 2n + 1 plants.
In Pedigrees 1936–26 + 1937–23, 24 and 25 the maturation division of the pollen mother cell was normal in 2n plants but abnormal in 2n + 1 plants; on the other hand, exactly opposite results were found in Pedigrees 1937–47, 48 and 49.
Pedigrees 1936–41 and 1937–34 bore the d_1 chromosome and all were 2n + 1. Two instances were found in which 2n plants exhibited lethal effects and 2n + 1 plants did not—an anomaly which may possibly be provisionally explained by lethal structural change in the genoms AB or the presence of a lethal gene or to abnormal chromosome combination.
Some plants with 2n + 2 fragments proved fertile and the progeny all carried the two fragments.
In contrast to other workers, the writer obtained two pedigrees of 2n + 2 plants which shewed fertility, though poor.
In Pedigrees 1936–15 and 1937–12 2n + 1 plants were two days ahead of 2n plants in reaching the stage of the maturation division.

1152. 633.11:575.127.5:633.14
575.12:578.08
Ljubimova, V. F.
(**Large-scale hybridization of cereals on isolated plots**).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : No. 5 : 33–34.

Sowings of winter wheat and winter rye were made side by side and in order to induce the two to flower simultaneously, the rye was sown twenty days after the wheat and the main stem was cut off just before it came into ear. The wheat ears were emasculated or removed as they emerged. In this way free pollination with rye pollen was ensured and a set varying from 19 to 57 per cent was obtained, which is much higher than the set in artificial pollinations, which amounted to only 12·7 per cent. The method was so successful that it was applied the following year also to crosses between different wheat varieties, when the set rose to as much as 81·7 per cent in some combinations.

1153. Oehler, E. 633.11:575.127.5:633.14
Heutiger Stand der Weizen-Roggenkreuzungen in Deutschland. (**Present day position of the wheat-rye crosses in Germany**).
Umschau 1936 : **40** : 1010–13, 1015.

A short account of the history of wheat-rye hybridization. No hybrids are yet on the market but they may be expected in a few years time.

1154. Meister, N. G. 633.11:575.127.5:633.14(47)
(**Wheat-rye hybrids**).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : No. 5 : 23–26.

Four varieties of winter wheat of the variety *erythrospermum* found to cross particularly easily with rye were used and a large number of hybrids were obtained from them by natural pollination. The F_2 segregates of the wheat type, which are the most fertile, were obtained in the largest proportion in back-crosses with wheat. A great variety of types was obtained, including many of the best known wheat types as well as some containing characters not known in wheat. One of the wheat-like lines produced was exceptionally early in maturity, ripening at the same time as Eliseevskaja rye, and was superior to either parent in hardiness.
Hybridization work is being carried out with these segregates of the wheat type and with the 56 chromosome amphidiploids. The hybrids of the amphidiploids with wheat are exceedingly varied in type and not inferior in grain quality; one in fact excelled the wheat parent in this respect.

Among the wheat-rye hybrids that have proved most promising in cultivation the following are mentioned: No. 46 131, suitable for mechanical harvesting; 434/154, very hardy, which property it retains even in spring, and at the same time high-yielding, fairly early and of good baking quality; and 27 36, of exceptional earliness, good winter-hardiness, high yield, and good quality. Marked increases of yield have been secured by growing these hybrids.

1155. LEDINGHAM, G. F. and THOMPSON, W. P. 633.11:575.127.5:633.14:576.354.4

The cytogenetics of non-amphidiploid derivatives of wheat-rye hybrids.

Cytologia, Tokyo 1938 : **8** : 377–97.

During the 14 years that F_1 wheat-rye hybrids ($2n = 28$) have been grown by the authors, 700 flowers have been artificially pollinated by wheat and 300 by rye, with no success. By open pollination 46 seeds have been obtained (average fertility 0·02 per cent). Of these 34 germinated to produce an F_2. It appears that all functional female gametes arise from restitution nuclei and cytological observations shew that some chromosomes may be missing and others duplicated. Restitution may occur at either first or second division, but more frequently at the first.

In the second generation the plants could be divided into three groups with somatic chromosome numbers centring around 28, 42 and 49 respectively.

The first group consisted of 6 plants, with chromosome numbers ranging from 24 to 32. They shewed a general resemblance to the F_1 in external characters, in the course of meiosis and in their sterility. It is believed that they are produced by the parthenogenetic development of unreduced egg cells, the variation in their chromosome numbers being the direct result of irregularities in the production of restitution nuclei.

The second group contained 10 plants, chromosome numbers ranging from 41 to 45. Their external appearance and their meiosis (typically $14_{II} + 14_I$) indicate that these are the product of pollination by wheats of the emmer group. It is pointed out that some of the emmer characters thus introduced are not unlike rye characters.

The third group comprises 16 plants, chromosome numbers ranging from 47 to 50. At meiosis these plants typically have 20–21 bivalents and from this and their preponderance of wheat characters it is concluded that they result from pollination by hexaploid wheats.

The remaining 2 of the 34 F_2 plants obtained were completely sterile and their cytological constitutions are not known.

Most of the plants of the second group were, like those of the first, completely sterile, but some F_3 plants were obtained and they all had about 42 chromosomes. Some lines were continued to the eighth generation. Most of the sub-lines became stabilized with 21 pairs of chromosomes; no rye characters but in some cases certain emmer characters persisted. A few returned to a stable condition with 14 pairs and a preponderance of emmer characters.

The plants of the third group were much more fertile and the later generations from these plants were studied in some detail. F_3 plants had chromosome numbers ranging from 38 to 54 and the majority formed 21 bivalents, though in one plant as many as 25 bivalents were found. Some 17 lines were carried past F_3 and in many sub-lines as far as F_8, selection being made for rye characters and for chromosome numbers greater than 42. As soon as a line returned to the condition of 21 pairs and no rye characters it was discontinued. In spite of this selection no line could be established in a true-breeding condition with rye characters or with extra chromosomes. A few lines did shew characters which were not those of *vulgare* wheat, but these were found to be due to outcrossing to a tetraploid wheat in the earlier and more sterile generations. The average number of univalents decreased from 10·0 in F_2 to 00·6 in F_7. Plants with 22 bivalents were found in F_3 and later generations but they are usually sterile and when they are not their progeny ultimately revert to 21 bivalents.

In an F_2 plant of the first group, with 31 chromosomes usually forming 9 or 10 bivalents, a young stamen was found in which about a quarter of the pollen mother cells of one pollen sac had 62 chromosomes. These regularly formed 31 bivalents many of which were secondarily associated in pairs. Occasional secondary associations of bivalents observed in other plants

may also be due to chromosome duplication but no evidence for this hypothesis could be detected.
One F_4 plant was found to be a haploid with 28 chromosomes, which usually remained unpaired at meiosis. It is believed to have developed from a 28 chromosome egg without fertilization.

1156. 633.11:575.127.5:633.289
633.11:581.143.26

*Tzitzin, N. V.

(What does crossing wheat with *Agropyrum* give?)

Novoe v Sel'skom Khozjaistve (What is new in agriculture) published by Sel'khozgiz, Moscow 1937 : No. 7 : Pp. 45.

The various characters of the weed *Agropyrum* that it would be desirable to introduce into our wheats are discussed, and the first generation hybrids of the species that cross with wheat are described (Cf. "Plant Breeding Abstracts", Vol. V, Abst. 78). The hybrids are now used for pollinating the sterile hybrids, so as to avoid the necessity of back-crossing. The F_2 hybrids obtained in this way are more promising as regards perennial habit and most of the other characters of interest. Perennial forms of the wheat type have now been obtained and two of these are described. Both hybrids have 56 somatic chromosomes and 28 regular bivalents were formed at metaphase I. The number 56 was apparently arrived at as follows: *T. vulgare* var. *lutescens* 062 (n = 21) x *A. glaucum* (n = 21) $\geqslant$ F_1 (2n = 42); at metaphase I the F_1 forms $7_{II} + 28_I$, the bivalents divide regularly and the univalents are distributed in numbers varying from 0 to 28; an egg cell containing 35 chromosomes being pollinated by a 21 chromosome wheat pollen grain would thus produce the individual with 2n = 56. This F_2 plant formed 21_{II} and 14_I, the univalents being mainly *Agropyrum* chromosomes; gametes containing from 21 to 35 were formed. By selfing, the union of gametes containing 28 chromosomes and over gives rise to plants containing a number of *Agropyrum* characters, forming 28 bivalents and *n* univalents (n = 0 to 14), the gametes with no univalents being the most viable, which results in the tendency of the later generations to contain 56 balanced chromosomes.
Of the annual hybrids 183 constant forms are being tested. Most of them are equal to the standard wheat varieties in yield, some are superior and better in grain quality and some are absolutely immune to smut, others to rust.
Winter wheat in the Omsk region is destroyed not by the winter frosts of –35–40° C. in November–December; but by the frosts, much less intense, that occur in February, March and April. The varieties that suffer most damage have been found to lose sugars and other food materials during the winter and to have proteins that are much more easily coagulated than those of hardy varieties and in particular those of *Agropyrum*. Some of the F_1 hybrids are identical with *Agropyrum* in the reaction of their proteins. The races of *A. glaucum* differ in their hardiness, those with the longest thermo-stage (over 45 days) being the hardiest. The desired hybrid is one with a long thermo-stage, capable of forming the maximum amount of food material and consuming the minimum during the winter, possessed of stable proteins and the maximum amount of bound water. All these factors are required in combination in order to produce a hardy type and no cultivated form exists in which they are all equally well expressed. Among the hybrids however, there is every reason to expect the appearance of the desired combination.
Some of the hybrids proved to be of an uncommon degree of drought resistance, tolerance of various different kinds of drought being observed among them.
Artificial infection with bunt (*Tilletia*) shewed a number of the hybrids to be immune under conditions that gave a 50 per cent infection in standard varieties such as *Caesium* 0111 and *Milturum* 0321. Many of these hybrids were also immune to smut (*Ustilago*).
Several of the hybrids produced loaves of greater volume than *Caesium* 0111, which was exceeded by 17·5 per cent and *Lutescens* 062, which was exceeded by 24 per cent. The porosity of the hybrids was also excellent and surpassed that of the standard wheats.

---

* An extended summary of this work is on file at the Bureau.

1157. Smith, G. S. 633.11-1.531.2:578.08
Gummed-paper tape for space-planting wheat.
J. Amer. Soc. Agron. 1938 : **30** : 348–52.
In the simple machine described wheat grains are spaced along a strip of gummed paper and covered with tissue paper. To sow the seeds, the strip is laid with the tissue paper upwards and covered with soil.

1158. Sinisalo, J. 633.11-1.547.6:575
633.16-1.547.6:575
Die für das Reifen gewisser Sommerweizen- und Gerstensorten erforderlichen Wärmesummen und Anzahlen von Wachstumstagen. (**The amount of heat and the number of days growth required for the ripening of certain varieties of spring wheat and barley**).
Maataloust. Aikakausk. 1937 : **9** : 194–212.
Varietal differences in the amount of heat and the length of the growth period required for ripening were found in barleys and spring wheats. Meteorological factors and locality also affect the maturation period.
Some Finnish varieties were included in the tests.

1159. Wang, C. M.,
Chang, W. H. and
Tang, C. H. 633.11–1.577:519.24
(**A study on the partial correlation between yield and other quantitative characters in wheat**).
J. Agric. Ass. China 1935 : No. 142–143 : 49–68.
This study which included 20 varieties of wheat was commenced in 1932 and the work was still in progress after 1934. The characters studied and the symbols used were weight of the whole plant, f; number of eared tillers per plant, g; density of seed, h; weight of seed, i.e. absolute weight of the seed of main ear, x; weight of the main stalk, y, and height of the main stalk, z.
The analyses of variance and covariance were applied to eliminate the variation due to the years and varieties and to obtain the sums of variance and products. Karl Pearson's mean moment product formula was employed to calculate the coefficients of correlation.
Data of the variance, covariance, simple coefficients of correlation and the partial coefficients of correlation for all the above mentioned characters were presented.
The following coefficients of correlation calculated from the residual variances and co-variances were significant, $r_{xy} = 0{\cdot}4261$, $r_{xf} = 0{\cdot}7738$, $r_{xh} = 0{\cdot}8019$, $r_{yf} = 0{\cdot}7260$ and $r_{fh} = 0{\cdot}6587$. Of the five fourth order partial coefficients of correlation calculated from the total coefficients of correlation only two were significant, viz., $r_{xf.yzgh} = 0{\cdot}5041$ and $r_{xh.yzfg} = 0{\cdot}4449$; while only one out of the three corresponding second order partial coefficients of correlation was significant, namely, $r_{xh.yf} = 0{\cdot}5579$. T.C.C.

1160. 633.11–2.111:575"791"
Timofeeva-Tjulina, M. 581.143.26.03:633.11
(**Winter-hardiness of varieties of winter wheat**).
Sotsialističeskaja Rekonstruktsija Sel'skogo Khozjaistva (Socialist Reconstruction of Agriculture) 1937 : No. 8 : 153–61.
In order to ascertain the causes of the unsatisfactory performance of the standard regionalized and the selected varieties in various regions of the U.S.S.R., one hundred varieties of winter wheat were tested for winter-hardiness by hardening at temperatures from 4-5°C., thawing and subsequent freezing at graduated temperatures, from 10 22° C. under relatively uniform conditions during the year 1935/36 which had not a severe winter. The vernalization stage was also observed. The technique is fully described. Winter-hardiness is defined as resistance to the complex of unfavourable conditions of the autumn, winter and spring period.
As the first requirement for winter-hardiness the plant must have a long vernalization stage.

Secondly good hardening capacity is needed, i.e. the capacity for developing after vernalization the maximum resistance to the unfavourable conditions of the autumn, winter and spring. And finally the plant should be well able to retain its hardening capacity (i.e. resistance) during the thaws of winter and early spring.
The above three desiderata formed the basis on which the experimental varieties were ultimately grouped and the possibility of improving types deficient in one or other of the necessary components of winter-hardiness by crossing them with suitable varieties to counteract defects is indicated, as well as the necessity of considering the role played by temperature, length of day, and good methods of cultivation in improving winter-hardiness. Attention is also drawn to the existence of intra-varietal differences in this characteristic.

1161. MEDVEDEV, G. M. 633.11–2.111–1.521.6:581.13
(An experiment on the characteristics of drought resistance of spring wheats).
Selektsija i Semenovodstvo (Breeding and Seed Growing) **1937** : No. **7** : 28–29.
The intensity of assimilation under drought conditions as judged by the Sachs half-leaf method was found to correspond with the drought resistance determined by field tests of a number of varieties determined over a long period of years. The behaviour of the unusually drought-resistant variety Erythrospermum 0841 was peculiar, its assimilation being highest under drought conditions and diminishing as the humidity increased. Another variety, Erythrospermum 0341, shewed the converse, having its highest assimilation under humid conditions and the author thinks that hybrids of these two should be of interest.

1162. GERLACH, G. 633.11–2.13–1.521.6
Die Widerstandsfähigkeit von Weizenzuchtsorten gegen Hagel. (**The resistance of wheat varieties to hail**).
Dtsch. landw. Pr. **1937** : **64** : 239–40.
The conclusion is reached from observation and experiments extending over several years that there is no variety resistant to hail.
The damage caused by hail decreased with the development of the plant.

1163. ATKINS, I. M. 633.11–2.183–1.521.6:578.081
Relation of certain plant characters to strength of straw and lodging in winter wheat.
J. Agric. Res. **1938** : **56** : 99–120.
In this further report (Cf. "Plant Breeding Abstracts", Vol. VI, Abst. 849) it is shewn that when sufficiently extensive data on lodging are used, significant negative correlations between lodging and the breaking strength of the straw of a variety are obtained. The previous failure to obtain a significant correlation between these two characters may therefore be attributed to lack of sufficient data with respect to lodging.
Breaking strength of straw, being much more constant from year to year than lodging, is a useful attribute for evaluating new varieties with respect to tendency to lodge, particularly in breeding for resistance to lodging. The correlation coefficient between breaking strength and weight of unit length of straw, and that between lodging and weight of unit length were high enough to justify the use of weight per unit length instead of breaking strength. Determinations of the former are more quickly and easily made and in some respects are believed to be more accurate (Cf. also Abst. 1164 below).

1164. ATKINS, I. M. 633.11–2.183–1.521.6:578.081
A simplified method for testing the lodging resistance of varieties and strains of wheat.
J. Amer. Soc. Agron. **1938** : **30** : 309–13.
A simple chopping machine is used to cut 10 cm. lengths of straw near the base. The weight of these is closely correlated with the breaking strength of the straw.

1165. Stakman, E. C.
Christensen, J. J. and 633.11–2.4–1.521.6:575
Becker, H. 633.16–2.4–1.521.6:575
Pathologische Probleme bei der Züchtung krankheitswiderstandsfähiger Weizen- und Gerstensorten im Sommerweizengebiet der Vereinigten Staaten von Nord-Amerika. (**Pathological problems in the breeding of disease-resistant varieties of wheat and barley in the spring-wheat district of the U.S.A.**).
Züchter 1938 : **10** : 57–68.

The history of the breeding of disease-resistant strains of wheat and barley in the U.S.A. is briefly reviewed with mention of the principal varieties produced and the progress which they represent as well as some of the problems encountered in their production. Hope and H–44, though neither is a really good wheat, are on the whole more resistant to most of the injurious diseases of spring wheats than any other available variety, except perhaps *Triticum Timopheevi*, and represent the highest achievement so far.

Hope and H-44 are, however, both susceptible to the bacterial disease "black chaff" and the resistance of Hope to black rust, *Puccinia graminis tritici*, is not always the same.

This fluctuation in resistance may be due to the presence or absence of certain races of rust or to variation in the resistance of the host plant to different races of rust as a result of external conditions. In the case of Hope, both are contributing factors.

The remarkable progress made in breeding for disease-resistance is pointed out and the knowledge gained of the problems still to be solved. This holds for other cereal crops besides wheat, but only the work on barley is further considered here. The present aim in barley breeding is the production of a high-yielding variety that combines good quality with resistance to smut and head blight. A smooth-awned barley is also frequently demanded. At present the main object in barley breeding is the creation of a high-yielding variety that combines good quality with resistance to Fusarial head blight and loose smut. *Ustilago hordei*, *U. medians* and *Helminthosporium gramineum* can be controlled by disinfectants. It is hoped that crosses with Peatland and a smooth-awn variety may give satisfactory results.

In conclusion some of the problems confronting the breeder of resistant varieties are pointed out, such as physiological races, the occurrence of new races by mutation and other means; the necessity of mature plant resistance in the parents used for breeding, etc., and finally the importance of a knowledge of the host plant, its inheritance, ecology and resistance, etc., and other essential points are briefly discussed.

1166. 633.11–2.42–1.521.6:575
Vik, K. 633.11 Fram
Melduggresistens hos vårhvete. (**Resistance to powdery mildew in spring wheat**).
Meld. Norg. LandbrHøisk. 1937 : **17** : 435–95.

Although powdery mildew, *Erysiphe graminis tritici*, does not cause as much damage to the crop as some other diseases such as rust, yet the loss in yield due to mildew attack may be considerable.

No varieties are immune but a land variety, J 03, was found to be very resistant and among foreign varieties was an unnamed Japanese sort that was also resistant.

A series of crosses was made between both resistant and susceptible varieties. These crosses shew that the best results were obtained when one of the parents was resistant and suggest that resistance is a dominant character.

The two resistant lines were, however, not satisfactory in other respects and a further series of crosses over a number of years was made to combine high yield, etc. with resistance.

The results of these crosses are recorded in detail and also variety trials and the effects of date of sowing and of different manurial treatment.

Finally two of the best lines 076 13 and 076 63 gave 26 and 21 per cent higher grain yield than Ås wheat, one of the best non-resistant varieties.

Of these, the first, 076–13, is being distributed under the name of Fram wheat; besides resistance to mildew it is rather earlier ripening than Ås wheat, has larger grain but it has not quite the same stiffness of straw. The other line will probably be distributed later.

1167. Anodin, P. S. 633.11–2.451–1.521.6:575
(Spring wheat resistant to smut and bunt).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : **7** : 30–31.
Two varieties Caesium 0111 and Graecum 0283 having desirable economic characters were crossed with Milturum 0274, which is resistant to smut and bunt. Amongst the progeny forms more resistant than either parent and not inferior in agronomic qualities were obtained. Other promising parental combinations are now being tried.

1168. 633.11–2.452–1.521.6:575.11
Vohl, G. J. 632.452:576.16
Untersuchungen uber den Braunrost des Weizens *Puccinia triticina* Erikss.
(Investigations on brown rust of wheat, *P. triticina* Erikss.)
Z. Zücht. 1938 : A **22** : 233–70.
The first part of the paper is devoted to investigations on the geographical distribution of the physiological races of brown rust and it is of interest that, for practical purposes, the 40 races known in Europe can be conveniently divided into 2 or 3 groups.
The second part deals with the field resistance of certain varieties of spring wheat at different stages of development.
Three groups are distinguished; the first includes the very susceptible varieties Hohenheimer 25, Quax and Heines Kolben. The second group is resistant to all the races tested and includes Marquis, Marquillo, Thatcher, D.C.2305, Hope, H_{44}, 38 M.A. and Garnet and Reward. These wheats shew the typical features of field resistance, susceptibility in the young stages, beginning of resistance when shooting starts, greatest resistance during heading and flowering and a gradual decrease in resistance toward the end of the vegetative period.
The third group includes those varieties that are resistant to one or more races in the seedling stage, retain their resistance until towards the end of the vegetative period and only shew a slight susceptibility in the later stages. To this group belong Hard Taganrog, Lin Calel, Mindum, Normandie and Vencedor.
Varieties from these last two groups are recommended as parents when breeding for resistance.
In the third part of the paper the inheritance of resistance is investigated.
For seedling resistance 11 crosses were made using Ardito, Varonne and Normandie as the resistant parents. In the first two, resistance is a simple recessive factor, in the last, a simple dominant. For the investigation of field resistance 5 crosses were made between spring x winter wheats and 16 spring wheat crosses. The resistant parents were Marquis, Thatcher, Lin Calel, 38 M.A., Hope, H_{44} and Hard Taganrog.
In crosses with winter wheats the resistance of Thatcher behaved as a simple recessive but with spring wheats as a simple dominant.
Investigations on the quality of the F_2 plants by Pelshenke's method shewed that quality and behaviour towards rust are independently inherited.
The resistance of the Lin Calel, 38 M.A., Hope, H_{44} and Hard Taganrog was inherited as a simple dominant.

1169. Barmenkov, A. and
Panchenko, N. 633.11–2.452–1.521.6:578.08
(A micro-chamber for testing the resistance of cereals to rust and checking it on breeding material).
Plant Protection, Leningrad 1937 : No. 14 : 73–79.
A fuller description of the apparatus referred to in "Plant Breeding Abstracts", Vol. VIII, Abst. 450 with a report on its efficiency in testing the resistance of 26 varieties and species of wheat for resistance to 6 races of *Puccinia triticina* (20, 67, 65, 66, 17 and 69) collected from different sources. The performance of 17 winter varieties of *Triticum vulgare*, a new species *T. Vavilovianum* and 8 F_1 hybrids of winter forms of the former species shewed the winter wheats to be most subject to attack by race 69. The hybrid Lutescens 0329 x Minhardi (U.S.A.) was susceptible to all 6 races whereas the reciprocal cross gave an F_1 resistant to race 67. The new species *T. Vavilovianum* was resistant to none of the races tested; but the

general conclusion from the experiment indicates that the Russian world collection of wheats has many forms resistant to races of *P. triticina* to which the existing standard varieties are susceptible.

1170. Weickmann, G. 633.11–2.7:664.641.016:578.081
Beitrag zur Qualitätsuntersuchung an wanzenstichigem Weizen. (**Contribution to the investigation of quality in wheat attacked by wheat bugs**).
Züchter 1938 : **10** : 89–91.
A method is described whereby the quality of the grain of wheat attacked by wheat bugs can be estimated.

1171. Pokrovskii, N. V. and Sustrina, V. E. 633.11:664.641.016
(**Breeding spring wheat for improved baking quality**).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : No. 5 : 26–28.
The method of Cutler and Worzella for determining baking quality was found to give results in good agreement with direct baking tests. The wheats of different geographical regions gave characteristic results; the best were the Indian wheats, which excelled both the Russian standard 062 and the standard North American varieties. Crosses have been made therefore of these wheats with the best Saratov wheats 062 and 0721.
In the *durum* wheats only two of the lines tested gave better results than the standard *Hordeiforme* 0432; the hard wheats from Syria, Palestine and North-west Africa were the best in quality and hence most promising for breeding.

1172. Méneret, G. 633.11:664.641.016:575.11
Observations sur l'hérédité du caractère "qualité" dans quelques croisements de blés tendres. (**Observations on the inheritance of the character "quality" in some soft wheat crosses**).
Ann Épiphyt. Phytogénét. 1937 : **3** : (N.S.) : 459–69.
An examination of the F_2 progeny of crosses between the good quality wheat, Providence and other varieties of inferior quality by Pelshenke's method, shewed that "quality" is a recessive character controlled by several factors. Transgression occurred and was stable in some progeny.

1173. 633.11.00.14(47.1)
Pesola, V. A. 633.11:575(47.1)
Jokioisten kevätvehnäjalosteet. (**The improved spring wheat varieties of Jokioinen**).
Valt. Maatalousk. Tiedon. 1937 : No. 129 : Pp. 20.
Trials are recorded of the wheats Sopu, Hopea and other lines—all derived from a cross of the Canadian Marquis wheat by the Finnish variety Ruskea which was bred at the plant breeding station at Tamisto.
Sopu proved to be an early strain ripening before either of the above parent varieties, in contrast to Hopea which was intermediate in earliness and hectolitre weight. Both Sopu and Hopea outyielded the parent forms and were superior in baking quality in which they also surpass all existing Finnish wheats. In resistance to *Ustilago tritici*, *Puccinia glumarum* and *P. triticina* Hopea resembled Marquis, and Sopu resembled Ruskea; but both Hopea and Sopu had stronger straw than the parent forms. Data on comparisons with other varieties are also given. J. S.

1174. Kihara, H. 633.11 *Aegilops*:575.127.2:576.312.35:576.354.46
Synthesized allotetraploid F_2 individuals obtained from the cross *Aegilops speltoides* x *Ae. umbellulata*.
Jap. J. Genet. 1937 : **13** : 224–26.
Out of eighteen F_2 plants from the cross *Ae. speltoides* (2n = 14) x *Ae. umbellulata* (2n = 14) twelve had a somatic chromosome number of 28; others were observed with 2n = 21, 2n = 27

and 2n = 27–28. Two plants obtained by selfing had 2n = 28 and the following chromosome associations instead of the 14_{II} expected: $13_{II} + 2_{I}$, $12_{II} + 4_{I}$, $10_{II} + 2_{IV}$ and $9_{II} + 2_{III} + 1_{IV}$. Fertility in F_1 and F_2 was poor as compared with the parents.
Whether the complex chromosome associations are due to segmental interchange requires further investigation.
It is suggested that studies of the allotetraploids produced by the author and of allopolyploids investigated by other workers might be interpreted as shewing that unstable associations are formed in the early generations but bivalents only in later generations.

1175. Kopel'kievskii, G. V. 633.12:575(47)
(Breeding buckwheat).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : No. 5 : 28–33.

Mass selection of buckwheat was started in 1917 at the Šatilov (now Kursk) station and a variety of high nutritive quality and large grain was produced and named Bogatyr'. By further individual family selection in this variety a strain with still larger grains was isolated in 1929; it was also 10 days earlier and was named variety B.
Observations have shewn that cross-pollination takes place in buckwheat, the pollen being transmitted both by wind and insects. Spatial isolation is therefore used in breeding work. A scheme of breeding is described whereby an improved variety can be produced in seven years. By selecting only the largest seeds of a population a yield increase of as much as 44 per cent has been obtained.
In addition to the ordinary heterostylous forms of flower a new type has been found in a number of individuals in which both pistil and stamens are equally long.
Inbreeding by self-pollination has been found to be quite possible. Dwarfs and other anomalies segregate in the inbred generations. A marked reduction in yield was observed in the first inbred generation but the yields become progressively higher again in the later generations.

OATS 633.13

1176. 633.13:575–181.13
A dwarf oat found in a Nortex-Victoria cross.
J. Amer. Soc. Agron. 1938 : **30** : 347–48.

In the F_6 of the cross Nortex x Victoria there appeared a dwarf plant which has bred true for three seasons. It has stiff, strong culms, a compact panicle with awns short and weak or absent, while both parents have long, prominent awns. The dwarf is moderately resistant to crown rust, but less so than Victoria.
It may be of value in breeding for reduced height and awn size and for stem strength, but attempts to cross it with other oats have so far been unsuccessful.

1177. Smith, D. C. 633.13:575.11.061.634
Occurrence of albino seedlings in Victoria oats.
J. Hered. 1938 : **29** : 63–64.

A single plant of the oat variety Victoria produced 94 normal and 21 albino seedlings.

1178. 633.13:581.48:575.127.2:575.11
Middleton, G. K. 633.13:575.242
Inheritance in a cross between *Avena sativa* and *Avena sterilis Ludoviciana*.
J. Amer. Soc. Agron. 1938 : **30** : 193–208.

In a cross between *A. sativa* var. *Aurora* and *A. sterilis Ludoviciana* the inheritance was studied of basal articulation, colour of lemma, dorsal and basal pubescence and strength of awn.
In the F_2 there was segregation for basal articulation into 1 cultivated : 2 intermediate : 1 wild (sucker-mouth).
The black colour of the wild grain (lemma colour) was epistatic in F_1 to the yellow of *sativa* and in F_2 there was segregation into 12 black : 3 red : 1 yellow, with a close linkage between red and

wild type articulation; no crossovers were found in an F_2 of 868 plants but in F_3 one plant with intermediate articulation was yellow and bred true for yellow in the next generation while segregating for articulation.
Both grains of the wild parent were dorsally pubescent while those of the *sativa* parent were glabrous. In F_2 and F_3 all black-grained plants had hairs on the back of the lower grain, but when the articulation was cultivated type the hairs were more sparse on the upper grain than when it was wild type.
The callus at the base of the lower grain of the wild parent carried short hairs, while the cultivated parent has a smooth base except for an occasional hair of medium length. In the F_1 there was a tuft of medium long hairs on either side of the base and in F_2 a new type of basal hairs appeared, called long. Grouping the intermediate forms with the short haired, a ratio of 3 short : 1 long was obtained; there was a tendency for grains with *sativa* articulation to produce no hairs and this is ascribed to the absence of the callus on which the hairs are produced or to a modifying factor associated with the factor for *sativa* type of articulation. The factor for long hair is apparently contributed by the *sativa* parent and is not linked with that for basal articulation.
The wild parent has two strong, geniculate, twisted awns while the *sativa* parent is awnless except for an occasional weak awn on the lower grain. The F_1 had awns on the lower grains only and varying in strength. In later generations plants with wild type articulation had two strong awns like the wild parent while in the cultivated groups there was one awn, on the lower grain, or none; when present it varied in strength. It appeared that an inhibiting factor contributed by the *sativa* parent modifies awns and may be the same factor as modifies the basal hairs.
The appearance of *fatua*-like plants in one F_2 and three F_3 families is ascribed to chromosomal aberration rather than to natural crossing.

1179. Rademacher, B. 633.13–2.19–1.521.6
Gibt es gegen Dörrfleckenkrankheit widerstandsfähige Hafersorten? (**Are there any varieties of oats resistant to grey speck?**)
Dtsch. landw. Pr. 1936 : **63** : p. 362.

In estimating the degree of resistance of varieties of oats to grey spot, it is necessary to take into account the effect on yield as well as the amount of spotting on the leaves. Of 170 varieties of oats tested for resistance to grey spot, none could be described as immune, most were susceptible but the following German varieties were definitely less susceptible, Rotenburger Schwarz and Schwarzer Präsident; none of the white or yellow oat varieties were as resistant as the black but some are moderately resistant. A number of foreign, resistant varieties are also being tested.

1180. Rademacher, B. 633.13–2.19–1.521.6:575:631.828
Kupfergehalt, Kupferbedarf und Kupferaneignungsvermögen verschiedener Hafersorten als Grundlage für die Züchtung gegen die Heidemoorkrankheit widerstandsfähiger Sorten. (**Copper content, copper requirement and copper assimilation capacity of various oat varieties as basis for the breeding of varieties resistant to reclamation disease**).
Z. PflKrankh. 1937 : **47** : 545–60.

Some varieties of oat suffer from reclamation disease when grown on soils deficient in copper, other varieties are resistant. The copper content of oats is a varietal and inherited character. In the present investigations the copper content was found, within the species *A. sativa*, to vary between 3:06–7.26 mg. in the straw and in the grain 4:19–14:17 mg. of copper per kg. of dry matter. In the resistant *A. strigosa* the figures were for the straw 5:73–9:46 and for the grain 8:79–12:26 mg. of copper per kg. of dry matter.
It was shewn that the difference in resistance is not to be found in different requirements of copper of the varieties, but the resistant varieties have a higher assimilation capacity for soil copper and this appears to be a physiological property. The importance of the breeding of resistant varieties is indicated.

1181. Reed, G. M. and
Stanton, T. R. 633.13–2.451.2–1.521.6:575.11
Inheritance of resistance to loose and covered smuts in Markton oat hybrids.
J. Agric. Res. 1938 : **56** : 159–75.

Reed, G. M. and
Stanton, T. R.
Inheritance of resistance to loose and covered smuts in oat hybrids.
J. Amer. Soc. Agron. 1937 : **29** : 997–1006.

The first paper gives the results of six crosses involving the variety Markton, which is resistant to both loose smut (*Ustilago avenae*) and covered smut (*U. levis*).

The first group of hybrids consisted of Canadian x Markton, Early Champion x Markton and reciprocal and Victor x Martin. Canadian, Early Champion and Victor are susceptible to both loose and covered smuts. The data obtained from F_2 and F_3 suggest a two factor difference for resistance to loose smut and a single factor difference for resistance to covered smuts, resistance being dominant in each case. There were, however, deficiencies of susceptible progenies in F_3 in both series, though satisfactory infection of the susceptible parent was obtained. The inheritance of resistance to the two smuts was independent.

The second type of cross was represented by Gothland x Markton, Gothland being susceptible to loose, and resistant to covered smut. The F_2 plants gave 17·1 per cent infection with loose smut and 72·6 of the F_3 progenies were classed as segregating, none as susceptible and the rest as resistant. In spite of the resistance of both parents to covered smut a few infected F_2 plants and partly infected F_3 progenies were observed.

The third type of cross is represented by Monarch x Markton, Monarch being resistant to loose and susceptible to covered smut. The F_2 and F_3 data suggest a single factor difference for resistance to covered smut, with resistance dominant; here again there was a deficiency in F_3 of susceptible progenies. A few plants susceptible to loose smut were obtained in F_2 and smutted plants were found in several F_3 progenies.

The second paper describes the results from a further eight crosses.

The first group consisted of Seizure x Victor and Scottish Chief x Victor, Seizure and Scottish Chief being susceptible to loose and resistant to covered smut while Victor is susceptible to both. A high degree of susceptibility to loose smut appeared in F_2 and F_3, while the data for covered smut indicate a simple dominant factor for resistance.

The crosses Gothland x Monarch, Rossman x Monarch, Danish x Monarch, Seizure x Monarch and Monarch x Scottish Chief made up the second group. Monarch is susceptible to covered smut and resistant to loose smut while the other parents are susceptible to loose and resistant to covered smut. The data again suggest single dominant factors, one for resistance to loose smut and another, independent of the first, for resistance to covered smut. There were, however, excesses of segregating F_3 progenies.

The last cross described is Danish Island x Monarch, Danish Island being very susceptible to loose smut but only slightly susceptible to covered smut. Here again there appeared to be a single dominant factor for resistance to loose smut, but resistance to covered smut appeared to be recessive.

Throughout the experiments the same Missouri races of loose and covered smuts were used for inoculation.

1182. Pohjakallio, O. 633.13.00.14(47.1)
Tärkeimmät kauralaatumme maatalouskoelaitoksen kasvinjalostusosastolla jokioisissa suoritettujen kokeiden valossa.
(**Our most important varieties of oats in the light of test as carried on at the Plant Breeding Division of the Central Experiment Station of Finland in Jokioinen**)
Valt. Maatalousk. Tiedon. 1937 : No. 120 : Pp. 18.

An analysis of the performance of Finnish varieties of oats tested with Swedish, German and other varieties. Data were obtained on yield, earliness, stiffness of straw, percentage of husk, thousand corn weight, hectolitre weight and resistance to smut. Among the varieties bred at Finnish centres and as a result of the trials recommended for cultivation in districts of Finland are Simo, Strain-0312, Esa and Pellervo. J. S.

RYE 633.14

1183. 633.14:575.42:581.162.32

SPRAGUE, H. B. 633.14 Raritan

Breeding rye by continuous selection.

J. Amer. Soc. Agron. 1938 : **30** : 287–93.

An account is given of the breeding of the rye variety Raritan at the New Jersey Agricultural Experiment Station. Ten varieties and strains were combined and grown for two years, after which 216 superior plants were selected from a space-planted plot and used to found strains, first planted in September 1927. Selections were made annually and yield tests with each of the 216 strains were made each year, on a small scale, with control plots of New Jersey common rye. These tests have been continued annually up to and including 1937. In 1933, 98 strains were chosen as high-yielding, combined and planted in an isolated field in 1933-34 and 1934-35 for increase, producing the variety Raritan which was released for further testing. Although the 98 strains in 1932 and 1933 yielded 30·4 per cent more than the control, the variety Raritan has been found to give an increase of only about 10 per cent over common rye; this is about the same increase as is given by the whole 216 strains and the new variety would therefore appear to represent the increased vigour of the whole breeding nursery. The new variety appears to be comparatively stable.

In the three year period 1935–37 the 95 best strains in the nursery outyielded the control by an average of 44·7 per cent and the 216 strains by 30·6 per cent, the corresponding figures for the two year period 1932 and 1933 being 30·4 and 12·4. It therefore appears that the method of selection brings about an increase in yield. Certain advantages are claimed for the method.

Experiments to estimate cross-pollination were performed in 1930–31 and 1936–37. A block of 10 rows of Rosen rye (coloured grains) was planted next to a similar block of Wisconsin Pedigree No. 6 (colourless grains) and the amount of pollination of the latter by the former was estimated by the amount of xenia. In the adjacent rows, one foot apart there was about 25 per cent, in the most distant row, 10 feet away, about 4 per cent. It is considered therefore that the amount of cross-pollination from both sides is about 50 per cent.

MAIZE 633.15

1184. JENKINS, M. T. 633.15:575.12

The progress of hybrid corn in the corn belt.

Rep. Neb. Bd Agric. 1937 : 187–97.

Data are given shewing the rapid expansion of hybrid maize acreage since 1933 and the increased yield to be expected from good hybrids. Control and certification measures are discussed and also future trends in policy.

1185. KIESSELBACH, T. A. 633.15:575.12

Principles and practices of hybrid seed corn production.

Rep. Neb. Bd Agric. 1937 : 197–207.

An account of the method of providing hybrid seed maize.

1186. 633.15:575.12

MARSTON, A. R. and 633.15 Michigan No. 1218

DECKER, R. E. 633.15 Minnesota No. 402

Two more hybrid corns prove valuable in Michigan.

Quart. Bull. Mich. Agric. Exp. Sta. 1938 : **20** : 156–58.

A brief account of the performance of the new hybrids Michigan No. 1218 and Minnesota No. 402.

Michigan No. 1218 is a top-cross on the variety Rickett yellow dent by an inbred line (No. 1459) derived from the cross (F_1 Maize Amargo x Red Cob Ensilage) x Wisconsin No. 25.

Minnesota No. 402 is a double cross produced by the Minnesota Experiment Station. It is a very early hybrid and its parentage involves two Rustler inbred lines and two Minnesota No. 13 inbred lines.

1187. Lewis, R. D. and
Stringfield, G. H. 633.15:575.12(77:1)
Cooperative production of foundation stocks for certified corn hybrids in Ohio.
J. Amer. Soc. Agron. 1938 : **30** : 145–49.
An account of the organization of the production of hybrid maize seed in Ohio, for which purpose a corporation known as the Ohio Hybrid Seed Corn Producers has been formed.

1188. Hartley, C. P. 633.15:575.42
Mejoramiento, por selección, de la semilla de maíz. (**Improvement, by selection, of maize seed**).
Hacienda, N.Y. 1936 : **31** : 120–23.
The importance of seed selection by the grower is stressed and brief instructions are given for carrying it out.

1189. Longley, A. E. 633.15:576.312.34
Chromosomes of maize from North American Indians.
J. Agric. Res. 1938 : **56** : 177–95.
In a study of the pachytene chromosomes of maize strains obtained from 33 Indian tribes of the U.S.A., 18 loci for knobs were found on the first nine chromosomes. The number of knobs in a given plant varied from none (except for the nucleolar attachment of chromosome VI) to fourteen. The normal tenth chromosome has no knobs but an abnormal form occurs carrying on its long arm an additional piece which may have one or more knobs.
Considering the geographical distribution of the strains, it is shewn that those from Arizona and New Mexico are distinguished by a high frequency of knobs. Strains from Indian tribes of the south east have less knobs and those from the north slightly less still. In general the frequency of knobs in a strain increases as its source approaches Mexico.
B-type chromosomes were found to occur more frequently in plants with more than seven knobs than in those with less.

1190. Musiiko, A. S. 633.15:581.162.32
(**Artificial pollination of maize**).
Novoe v Sel'skom Khozjaistve (What is new in agriculture) published by Sel'khozgiz, Moscow 1937 : No. 2 : Pp. 15.
Owing to the excessively high temperatures at the time of flower development in the Odessa region the anthers tend to ripen before the stigma, thus occasioning a considerable loss in yield. Growers are therefore advised to pollinate their crops by hand and the method is described. An improvement in both yield and quality has resulted from its application.

1191. Anderson, D. C. 633.15–1.557:575.125
The relation between single and double cross yields in corn.
J. Amer. Soc. Agron. 1938 : **30** : 209–11.
A correlation of 0·90 was obtained between the actual yields of double crosses and their predicted yield, which is the average of the yields of the four single crosses not used in making the double cross, there being six possible single crosses between any four inbred lines (Cf. also "Plant Breeding Abstracts", Vol. VII, Abst. 198). Five inbred lines were used in the present study, giving 10 possible single crosses and 15 double crosses. Significant differences in yield were obtained within the three possible double crosses from given sets of four inbred lines and these differences were accompanied by significent differences in the predicted yields.

1192. Hoener, I. R. and
DeTurk, E. E. 633.15–1.842:581.13:575.42
The absorption and utilization of nitrate nitrogen during vegetative growth by Illinois high protein and Illinois low protein corn.
J. Amer. Soc. Agron. 1938 : **30** : 232–43.
Since 1896 two strains of maize from the variety Burr's White have been selected at the Illinois Agricultural Experiment Station for high and low protein content in the grain at

maturity. The mean protein content in 1896 was 10·92 per cent while after 40 generations of selection the low protein line had 8·01 per cent and the high protein line 21·63 per cent and the distributions of the two lines did not overlap.
Plants of these two strains were grown in culture solution, the only variable in which was the nitrogen. The superiority of the high protein strain in nitrogen absorption and assimilation is most evident at the 100 p.p.m. level and tends to disappear at higher or lower levels.
In discussing the results the author points out the need for studying the interaction between varieties and soil fertility.

1193. WELLHAUSEN, E. J. 633.15–2.3–1.521.6:575.11
Genetics of resistance to bacterial wilt in maize.
Res. Bull. Ia Agric. Exp. Sta. 1937 : No. 224 : 73–114.

In this further report on the inheritance of resistance to *Phytomonas* (*Bacterium*) *Stewarti* (Cf. also "Plant Breeding Abstracts", Vol. VI, Abst. 550) the crosses most extensively studied were OSF x WF and OSF x W–134. OSF is an inbred line of yellow dent, medium early, red-cobbed and very resistant; WF is an inbred white flint, early maturing, white-cobbed and very susceptible and W–134 is an inbred yellow sweet, very early maturing, white-cobbed and very susceptible.
The F_1 in each case was resistant and the data from the back-cross indicated that there were three dominant factors for resistance. One of these, *Sw*, confers a moderate degree of resistance and the second Sw_2 a rather less degree; together these two factors produce a very resistant plant, whether homozygous or heterozygous. The third factor Sw_3 produces only a slight increase in resistance. This hypothesis was confirmed by the results obtained in F_2 and F_3 and in the families raised from the back-cross plants. The segregation obtained depends on the virulence of the culture used for inoculation and on the severity of the attack.
Linkage between red cob colour and resistance was found, indicating that one of the factors for resistance is linked with *P* on the first chromosome. There was also an association between resistance and late maturity and between susceptibility and early maturity, but it is not known whether the association is physiological or due to genetic linkage. There was no association of resistance with starchy or sugary endosperm or with yellow or white endosperm and no marked association with ear row number.

1194. ROBERTS, E.,
HOLBERT, J. R. and
QUISENBERRY, J. H. 633.15–2.6–1.521.6:581.6
Preferences for certain genetic strains of corn exhibited by animals.
J. Amer. Soc. Agron. 1938 : **30** : 150–59.

Data are presented to shew that rats and mice exhibit a preference for certain strains of maize. It is suggested that palatability should be considered in plant breeding work.

BARLEY 633.16

1195. GUSTAFSSON, Å. 633.16:575.243.061.6:537.531
Studies on the genetic basis of chlorophyll formation and the mechanism of induced mutating.
Hereditas, Lund 1938 : **24** : 33–93.

Evidence from X-ray experiments with barley is presented to shew that the classification of chlorophyll mutations by their phenotypic effects corresponds, on the average, with the classification based on the degree of genotypic change involved. *Xantha* and *viridis* mutations for instance behave as though they were due to chromosome aberrations while *albina* mutations behave more like normal Mendelian recessives.

1196. Hoffmann, W. and Kuckuck, H. 633.16–2.42–1.521.6:575.11
633.16:581.42:575.11
Versuche zur Züchtung spelzenfreier, eiweissreicher und meltauwiderstandsfähiger Gersten. (**Experiments on the breeding of naked, high-protein and mildew-resistant barleys**).
Z. Zücht. 1938 : A **22** : 271–302.

The experiments on breeding hull-less and high-protein barley are described in the first half of this paper and those on breeding for mildew resistance in the second half.
For breeding a hull-less barley suitable for fodder, a many-rowed Italian naked barley and a two-rowed North African naked barley among others were crossed with German standard varieties in one set of experiments, a Japanese naked barley with German varieties in another and Abyssinian land varieties with naked grains were used for direct selection in a third.
The Kjeldahl method was used for the estimation of protein. Because of the great diversity of the parents and the polymeric inheritance of both yield and protein content the segregation was complex. The experiments shewed that the combination of yield, protein content and naked grain was a practical possibility.
There was less variation in protein content in the winter barleys than in the spring varieties. Although the winter varieties had, in general, a lower protein content than the spring varieties there seems to be no genetical reason why the protein content of the former should not be considerably increased. There was a correlation between higher protein content and the two-rowed character and between lower protein content and the many-rowed character.
For the experiments on breeding a barley resistant to mildew, use was made of some of the crosses already mentioned in the high protein experiments.
Only the four most important races (for Germany) of mildew, A, B, C and D were used.
The immune wild species, *Hordeum spontaneum nigrum*, was used as a parent in several crosses and the immunity was dominant. In one cross a 3:1 segregation was obtained, but not in others, and 1 main gene and several secondary genes are assumed. Back-crossing to the cultivated forms was resorted to in order to eliminate the brittle rachis and black grain of the wild parent.
Transgression was observed in crosses with the resistant Japanese barley and it is suggested that in this cross mildew resistance is conditioned by several recessive genes.

1197. Isenbeck, K. 633.16–2.484–1.521.6:575
Die Bedeutung der Faktoren Temperatur und Licht für die Frage der Resistenzverschiebung bei verschiedenen Sommergersten gegenüber *Helminthosporium gramineum*. (**The importance of the factors, temperature and light for the question of changes in resistance of various spring barleys to *H. gramineum***).
Kühn-Arch. 1937 : **44** : Pp. 54.

The effect of different degrees of temperature and of varying amounts and kinds of light both on the fungus and the host plant at the time of infection was investigated. The results indicate that changes in the temperature have a greater effect on the fungus than light and different lines react differently to different temperatures.
The effect of light and temperature on the plant is a varietal character and the breeder when testing for resistance must take into account these factors and their interactions.

1198. Laurila, V. 633.16.00.14(47.1)
Koti- ja ulkomaisia ohralaatuja vertailevissa kokeissa maatalouskoelaitoksen kasvinjalostusosastolla jokioisissa vuosina 1928–35. (**Comparing researches on Finnish and foreign barley varieties at the Plant Breeding Division of the Central Experiment Station in Jokioinen during the years 1928-35**).
Valt. Maatalousk. Julk. 1937 : No. 90 : Pp. 32 + 11.

In comparative tests of over 100 varieties of barley from Europe, North America, Australia and Russia yield, earliness, strength of straw, thousand corn weight, hectolitre weight and

smut resistance were determined. Lonhi barley proved far the best among the Finnish varieties; and among the early barleys of Finland, Perttu, Lappi II and Olli were in the first rank. The performance of varieties from other countries was poor in many instances. J. S.

MILLETS AND SORGHUMS 633.17

1199. Kisielev, D. A. 633.171:575(47)
(A new variety of millet).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : No. 6 : 22–23.

An improved variety of millet (*Panicum mileaceum Contrac. aureum* Al.), No. 0241, is described as giving 2 centners per ha. more than the standard variety in ordinary years or in dry years and much more still in moist years. Its grain is of a quality equal to the standard and rounder in form and of excellent flavour. It ripens one to two days earlier than the standard and is being widely distributed for cultivation.

1200. 633.174:575(73)
Parker, J. H. 633.174-2.411.2-1.521.6
Registration of improved sorghum varieties. I.
J. Amer. Soc. Agron. 1938 : **30** : 306–08.

Brief accounts are given of the following varieties, which have been registered as standard varieties: Club, a selection from Dawn kafir; Finney Milo, a selection from Dwarf Milo; and Early Kalo, a selection from Kalo, which is derived from a natural cross between Pink kafir and Dwarf yellow milo. Club and Finney Milo are resistant to *Pythium* root-rot.

1201. Snelling, R. O.,
Painter, R. H.,
Parker, J. H. and
Osborn, W. M. 633.174-2.7-1.521.6:575
Resistance of sorghums to the chinch bug.
Tech. Bull. U.S. Dep. Agric. 1937 : No. 585 : Pp. 56.

A report on studies during the last 15 years at Manhattan, Kansas and, for 5 years, at Lawton, Oklahoma.

The reaction of most of the important American varieties of sorghum to chinch bug (*Blissus leucopterus* Say) has been determined. In general milos and feterita are susceptible and sorgos and kafirs rather resistant; milos are the most susceptible and sorgos the most resistant, though there are numerous exceptions. Some susceptible varieties escape serious injury because of their earliness.

From crosses between susceptible and resistant varieties evidence was obtained that resistance is inherited. Hybrid vigour, when it occurs, confers a high degree of resistance and it is not clear whether the rather high average resistance of F_2 generations was due to dominance of resistance or persistance of hybrid vigour. The reaction of F_3 lines from the cross Sharon kafir (resistant) and Dwarf Yellow milo (very susceptible) suggested a 3 : 1 segregation in F_2, but other evidence indicates that the inheritance of resistance is more complex than this.

Resistant lines have also been obtained from susceptible varieties by selection. Some varieties gave inconsistent results in successive years and this is attributed to natural selection, seed being saved from the infested plots.

Height of plant, sweetness of stalk and stigma colour were the only characters which shewed any association with resistance and it is believed that this is only incidental. The tightness of the leaf sheath around the stem may be associated with resistance. No experimental evidence could be obtained to confirm the observation that the bugs appear to prefer susceptible varieties.

It is considered that material benefit can be obtained by growing resistant strains in areas subject to chinch bug infestation.

1202. 633.18:575(91.4)
ARAGON, V. B. 633.18 Elon-ram
The Elon-ram rice.
Philipp. Agric. 1938 : **26** : 832–43.
A detailed account of the breeding of the rice variety Elon-ram at the Philippine College of Agriculture. It was bred from the cross Elon-elon x Ramai, the object being to combine the superior quality of Elon-elon with the heavy yield of Ramai. Characterized by large panicles and strong tillering, it outyields both parents but is somewhat inferior to Elon-elon in quality.

1203. IMAI, Y. and
KASAHARA, K. 633.18:575.243.061.6:537.531
Inducing somatic mutation by applying X-rays to germinating seeds of *Oryza sativa*.
Jap. J. Genet. 1938 : **13** : 321–22.
Germinating seeds of a pure line of rice were X-rayed and the seedling progenies of the several ears of the resulting plants were examined for chlorophyll mutations. Out of 9272 ear progenies, 220 contained some chlorophyll deficient seedlings; in 55 progenies chlorophyll-deficient seedlings occurred only sporadically.
All the ears of a treated individual were never affected; most frequently only one ear was affected.

1204. MORINAGA, T. 633.18:576.354.46:575.127.2
(On the microsporogenesis of various interspecific hybrids of *Oryza*).
Jap. J. Genet. 1937 : **13** : p. 245.
During microsporogenesis in the F_1 of the crosses between *O. sativa* (2n = 24) and *O. minuta* (2n = 48), and between *O. sativa* (2n = 48) and *O. latifolia* about 36 univalents with some bivalents were generally formed; while in the cross between *O. minuta* and *O. latifolia* about 36 chromosomes comprising univalents and bivalents were found at diakinesis.
The author tentatively suggests that the genoms of *O. sativa* bear little relationship to those of *O. minuta* and *O. latifolia*, but that *O. minuta* must have one genom in common with *O. latifolia*.

1205. OPSOMER, J. E. 633.18:581.162.3:575
Recherches sur la "méthodique" de l'amélioration du riz á Yangambi. II. Etudes de biologie florale. Essais d'hybridation. (**Researches on the "methodics" of rice-breeding at Yangambi. II. Studies on the floral biology. Hybridization experiments**).
Publ. Inst. Agron. Congo Belge 1938 : Sér. Sci. No. 15 : Pp. 39.
The conditions under which flowering takes place in rice at Yangambi are noted and the course of anthesis is described. Experiments were made on the amount of natural crossing and the distance beyond which this fails to occur. The technique employed in selection, based on the results of these observations is recorded. Finally the technique of hybridization in use at the Station is described.

1206. JODON, N. E. 633.18:581.162.32:578.08
Experiments on artificial hybridization of rice.
J. Amer. Soc. Agron. 1938 : **30** : 294–305.
Data are given shewing the reduction in seed set caused by different kinds of clipping of the glumes for emasculation by removal of the anthers. Emasculation by this method was compared with hot-water emasculation and it was found that the latter gave a better set of seed. It has several other advantages, in particular being less laborious. The treatment consists in immersing panicles, when about two thirds exserted, in water at 40–44° C. in a thermos bottle; this kills the pollen without injuring the rest of the flower. Cold water (0° C.–3°C.) has a similar effect but the hot water treatment is considered to be more effective.

1207. Jodon, N. E. and
Beachell, H. M. 633.18-1.421
Row spacing and rate of seeding for rice nursery plats.
J. Amer. Soc. Agron. 1938 : **30** : 212–19.

Complex experiments on similar lines were carried out in 1936 at Crowley, Louisiana and Beaumont, Texas; there were four varieties, four rates of seeding, 60, 80, 100 and 129 lbs per acre and four different row spacings, 6, 8, 10 and 12 inches apart. The 6-inch plots were six rows wide, the 8-inch five rows, the 10-inch four rows and the 12-inch three rows wide. Border rows were discarded.

The analysis of variance shewed that differences between varieties were significant at both stations, differences due to seed-rate were not significant at either and differences due to row spacings were significant at Crowley but not at Beaumont, where the general level of fertility was much higher; at Crowley the yield per acre increased consistently as the row spacing decreased. None of the interactions was significant and it therefore appears that varietal differences were expressed equally over the full range of seed-rates and row spacings. Coefficients of variability indicated that at Crowley three-row plots with a 12-inch row spacing and only the centre row harvested were slightly more variable than plots of similar size with more closely spaced rows and two to four inside rows harvested. No such relation was found at Beaumont.

1208. Reyes, G. M. 633.18–2.484–1.521.6:575(91.4)
Disease-resistant rice hybrids produce superior yields in commercial trials.
Philipp. J. Agric. 1937 : **8** : 417–23.

Data are given on the yield of certain hybrid rice strains at the Maligaya Rice Station; of these Raminad Strain 3 (Ramay x Inadhica) has proved the best and is being multiplied for general distribution. The main aim in this breeding work was resistance to stem rot, *Sclerotium oryzae* Catt. (Cf. also "Plant Breeding Abstracts", Vol. VII, Abst. 1269).

HERBACEOUS FORAGE PLANTS 633.2

1209. 633.2:576.312.35:576.356.5(98)
Flovik, K. 633.2:576.312.34:576.354.4
Cytological studies of Arctic grasses.
Hereditas, Lund 1938 : **24** : 265–376.

The cytological methods used are described in some detail. The material was collected at Isfjorden in Spitzbergen.

The somatic numbers of three individuals of *Alopecurus alpinus* Sin. were determined. One a gigas type, had over 120 chromosomes, another 112 + 3 fragments and the third 114 + 2ff. Observations of meiosis shewed that the gigas individual had at least 130 chromosomes, with one fragment. Meiosis in this species was irregular, with associations of as many as six chromosomes, univalents, lagging and scattered chromosomes and micronuclei. Owing to the high degree of polyploidy there does not appear to be any constant chromosome number. Individuals of *Arctagrostis latifolia* (R. Br.) Griseb. from three localities in Coles Bay had the somatic number 62, suggesting that the species propagates itself vegetatively.

Arctophila fulva (Trin.) Rupr. had 2n = 42 chromosomes. Two chromosomes of the somatic set could be distinguished by their great length, suggesting that this species is an allopolyploid. The *Calamagrostis neglecta* (Ehrh.) P.B. examined by the author had 2n = 28, whereas Avdulov has reported 2n = 68–72 for the same species. The lower degree of polyploidy of the arctic form is considered surprising. The morphology of the chromosomes is given in full; since there are two very nearly identical diploid sets it is considered that this species shews a high degree of autopolyploidy. It is pointed out that if small differences in length were ignored there would be 5 chromosome types instead of 7. At meiosis a quadrivalent or a trivalent or both were noted in several cells and univalents were not uncommon. Secondary association was observed in some cells at first and second metaphase, giving 4 groups of two and 6 of one. Pollen formation was quite normal.

In the typically viviparous and highly polymorphic species *Deschampsia alpina* Toem. et Schult., one biotype was found to have 49 somatic chromosomes, another 41 and a third 39. Though the chromosome morphology could not be fully worked out, evidence was obtained suggesting that this is an allopolyploid species. Univalents and lagging chromosomes were observed at meiosis and the pollen was very variable in size.

Dupontia Fisheri R. Br. extends further north than its var. *psilosantha* (Rupr.) Scholander. The former was found to have 2n = 88 + 1 to 3 fragments and the latter 2n = 44 + 2 to 3 fragments. It therefore appears that the former is derived from the latter by chromosome doubling. One type of chromosome occurred twice in var. *psilosantha* and four times in *D. Fisheri*, supporting the above hypothesis and indicating that *psilosantha* is an allopolyploid.

Festuca rubra L. var. *arenaria* (Osb.) E. Fries had 2n = 42, with in one individual a supernumerary fragment. Morphologically, 7 types of somatic chromosomes were distinguished, each present 6 times. Meiosis was for the most part regular but trivalents, quadrivalents and sexivalents were encountered in about 6 per cent of the pollen mother cells.

Festuca ovina L. var. *brevifolia* (R. Br.) Hart was tetraploid, with 2n = 28. Morphologically 7 types of chromosome could be distinguished, each present 4 times.

Festuca ovina L. var. *vivipara* L. was found to have 49 somatic chromosomes. Morphologically these had homologies with the somatic chromosomes of *F. ovina* var. *brevifolia* and of *F. rubra* var. *arenaria* respectively. It is suggested that the viviparous variety is a hybrid resulting from the fusion of an unreduced gamete of *F. ovina* var. *brevifolia* with a reduced gamete of *F. rubra* var. *arenaria*. In addition to the Spitzbergen material, *F. rubra*, *F. ovina* and *F. ovina* var. *vivipara* were collected from arctic Norway. *F. rubra* was again found to be hexaploid; *F. ovina* was found to be diploid, with chromosomes differing morphologically from those of the Spitzbergen material; the viviparous *F. ovina* was of two types, one more robust and highly viviparous, which was tetraploid (2n = 28), the other semiviviparous and triploid. It is suggested that the first is a cross between *F. ovina* (n = 7) and *F. rubra* (n = 21) and the second a back-cross of this hybrid to *F. ovina*.

Heterocholoe alpina (Liljebl.) Roem. et Schult. had 2n = 56 chromosomes.

Phippsia algida (Soland) R. Br. had 2n = 28, the four genoms being morphologically homologous. *Phippsia concinna* (Th. Fr.) Lindeb. was also tetraploid, with four morphologically homologous genoms. Of *P. concinna* (Th. Fr.) Lindeb. var. *algidiformis* (Smith) Holmb., one specimen was examined cytologically and was found to have 2n = 29, being thus a trisomic. From its chromosome morphology it would appear to be a hybrid between *P. agida* and *P. concinna*. The chromosome morphology of these two species suggested that they are each autopolyploid and the fertility of the putative hybrid supports this conclusion.

Poa abbreviata R. Br. was found to have approximately 76 somatic chromosomes; of *Poa alpigena* (E. Fries) Lindm., two types were studied; one, of the *iantha* type, had approximately 77 and the other, of the *domestica* type had 84 somatic chromosomes. Meiosis in these two types was extremely irregular, but when progeny were raised from the 84-chromosome type, they were found to have again 84 chromosomes, suggesting that seed formation is apomictic. The sterile *P. alpigena* var. *colpodea* (Th. Fries) Scholander was found to have 2n = 51 + 5 ff. *P. alpigena* var. *vivipara* (Malmgr.) Scholander had 2n = 42 + 2 ff and its chromosome morphology suggested that it was allopolyploid; lagging chromosomes were frequent at meiosis. The somatic number of *P. glauca* Vahl. was estimated at 70–72. Meiosis was irregular yet the progeny had apparently the same number as the mother plant, again suggesting apomixis. Two biotypes of *P. alpina* L. var. *vivipara* from Spitzbergen had 2n = 44 and 2n = 44 + 4 ff respectively; a third from arctic Norway had 2n = 33. Meiosis was again irregular. *Poa arctica* R. Br. from three localities had 2n = 56. Meiosis was irregular and the constancy of the progeny again suggested apomixis. *P. arctica* var. *vivipara* (Malmgr.) Scholander had 2n = 56, including 4 very short chromosomes. Extreme irregularity was observed at meiosis, including syndiploidy and scattering of the chromosomes at second metaphase; only about 3 per cent morphologically good pollen was produced.

Puccinellia angustata (R. Br.) Rand. et Redf. was hexaploid (2n = 42) and its chromosome morphology suggests autopolyploidy; seven chromosome types were recognized. Meiosis is in general very regular and no higher associations than trivalents were noticed. *Puccinellia phryganodes* (Trin.) Scribn. et Merr., a sterile species, had 2n = 28; its chromosome morphology

indicates that it is an allopolyploid. Meiosis was irregular, univalents and multivalents were common, with as many as 12 chromosomes seen associated to form a chain. *Puccinellia Vahliana* (Liebm.) Scribn. et Merr. was the only diploid grass found in Spitzbergen. The morphology of its 14 somatic chromosomes is described and it is noted that as in *Calamagrostis neglecta* there would be 5 types instead of seven if minor length differences were ignored. Meiosis was usually regular, but occasional quadrivalents, trivalents and univalents were observed. Secondary pairing was noticed, giving two associations of two and three of one. One of the associations involved the two largest bivalents, which were already known from their morphology as somatic chromosomes to possess some degree of homology.
Trisetum spicatum (L.) Richt. had 2n = 28, both in the Spitzbergen material and in some from arctic Norway. The chromosome morphology suggests that it is an autopolyploid.
About 50 per cent of the pollen mother cells had regular meiosis, quadrivalents, trivalents and univalents occurring in the others.
In the discussion the high frequency of secondary constrictions in the somatic chromosomes is pointed out. It is suggested, from the chromosome morphology and from the secondary pairing observed that the primary basic number in grasses may be 5. With regard to the occurrence of polyploidy, the preponderance of polyploids in climatically unfavourable localities is stressed and it is mentioned that 80 per cent of the flora of Spitzbergen is polyploid. It is considered that hybridity, polyploidy and environment all play their part in the origin of the numerous viviparous forms of arctic grasses, which are discussed at some length.

1210. Jirásek, V. 633.2:582
Dnešní systematické členění Gramineí a jejich fylogenetické vztahy. (**The present day systematic division and arrangement of the *Gramineae* and their phylogenetic connexions**).
Věda Přír. 1935 : **16** : 159–64.
A summary of classifications of the *Gramineae*, especially from the phylogenetic standpoint, Diagrams are given to illustrate the relationships of the different tribes according Hayek, Bews and Schnellenberg.

1211. Sokolovskaya, A. P. 633.23:576.356.5:581.9
A caryo-geographical study of the genus *Agrostis*.
Cytologia, Tokyo 1938 : **8** : 452–67.
The sub-genus *Airagrostis*, representing the oldest and most primitive group of *Agrostis*, contains *A. interrupta* L., *A. Biebersteiniana* Claus., *A. elegans* Thore and *A. nebulosa* Boiss, all diploids (2n = 14). The subgenus *Trichodium* includes the species *A. canina* L., *A. Trinii* Turez., *A. borealis* Hartm. and *A. planifolia*, which apparently form an autopolyploid series. *A. canina* is diploid; *A. Trinii* comprises two races, one having 2n = 14 + 2 fragments and the other tetraploid (2n = 28); *A. borealis* an Arctic species is octaploid (2n = 56); *A. planifolia*, an alpine species, endemic in the Caucasian mountains, is hexaploid (2n = 42). The group *Albae* of the subgenus *Vilfa* includes the tetraploid species *A. alba* L, *A. vulgaris* With. (= *A. capillaris* L), *A. mongholica* Roshew and *A. sibirica* as well as the pentaploid (2n = 35) *A. prorepens* G. May (*A. stolonizans* Bess) which is considered to have been produced by interspecific hybridization. The group *Aristulatae* of the same subgenus, *Vilfa*, contains the hexaploids *A. hissarica* Roshev. and *A. gigantea* Roth. Though the latter is usually classified as a variety of *A. alba*, the author places it here on the basis of its morphology and karyology. The third group of this subgenus, *Clavata*, contains the hexaploid *A. clavata* and, according to the author, *A. hiemalis* (Walt.) Britt., a hexaploid species which spreads into North America. The subgenus *Vilfoidea* has only the tetraploid species *A. verticillata* Vill., which forms a connecting link with the genus *Polypogon*. *P. litoralis* (2n = 42) is possibly a hybrid between *P. monspeliensis* and an *Agrostis* species.
The distribution of the different species is briefly described and illustrated. In general it is found that the centre of the genus is in the Mediterranean region and polyploid forms have made their appearance as the eastern and northern limits were approached and also when migration into alpine regions occurred. This is considered to be a result of the influence of

extreme climatic conditions on the reduction division. In the subgenus *Vilfa* hybridization has also to be considered. Eastern Asia represents a secondary centre of origin, for species with high chromosome numbers.

1212. Hübner, R. 633.262:575
Beiträge zur Züchtung von wehrloser Trespe (*Bromus inermis*). [**Contributions to the breeding of awnless brome (*B. inermis*)**].
Pflanzenbau 1938 : **14** : 269–88.

Up to the present this grass, the awnless brome, has attracted little attention from agriculturalists. Most references to it in the literature are botanical but in fact it has considerable value as a forage plant for poor soils. Individual plants were selected and tested to find the most suitable parental forms. Three groups are distinguished on the basis of panicle formation (1) rich in seed and leaf-mass, (2) poor in seed, rich in leaf-mass, and (3) rich in seed and poor in leaf-mass. These characters were transmitted to the progeny.
Tests for protein content of the leaves, after dividing the plants into four groups according to the colour, light, medium, dark and very dark, shewed that the darker the colour the higher the protein content.
Experiments on the inheritance of leaf colour are to be made.

1213. Strelkova, O. 633.285:576.356.5:581.9
Polyploidy and geographo-systematic groups in the genus *Alopecurus* L.
Cytologia, Tokyo 1938 : **8** : 468–80.

The grouping of the species used by the author follows that given by Ovczinnikov in the Flora of the U.S.S.R.
In the group *Annuae*, *A. myosuroides* Huds., *A. aequalis* Sob. and *A. amurensis* Kom. were found to be diploids (2n = 14) and *A. geniculatus* L. a tetraploid (2n = 28). *A. longearistatus* has not been examined cytologically. *A. utriculatus* Pers., not found in the U.S.S.R., is also diploid. The *Annuae* group has a wider range than the other groups of the genus.
The *Pratenses* group contains *A. pratensis* L, *A. soongoricus* V. Petr., *A. seravachanicus* Ovcz., all tetraploids. No fragments were found in any of the strains of *A. pratensis* examined, though they had been previously reported by Ranken.
Of the five species of the group *Ventricosae* only *A. ventricosus* Pers. and *A. mucronatus* Hack. were examined cytologically and both were tetraploid.
The group *Vaginatae* includes 8 species of which were examined *A. vaginatus* Pall., *A. dasyanthus* Trautv., *A. textilis* Boiss., *A. himalaicus* Hook and *A. glacialis* C. Koch. All were octaploid (2n = 56). The *Vaginatae* are typically mountain species.
There are seven species in the group *Alpinae*, but only two were examined, *A. borealis* Trin. and *A. pseudobrachystachus* Ovcz., both of which had 2n = 98. Avdulov has reported 2n = 70 for *A. Roschevitzianus* Ovcz. It therefore appears that the *Alpinae*, whose distribution is arctic, extending southwards along mountain ranges, are characterized by very high degrees of polyploidy.
The distributions of the different species and groups are briefly indicated and illustrated. The Mediterranean region is considered to be the centre of origin of the most primitive group, the *Annuae* and of the genus. The mountains of the Caucasus and of Central Asia represent secondary centres of origin. As in *Agrostis* (Cf. Abst. 1211) there is a correlation between extreme climatic conditions and a high degree of polyploidy.

LEGUMINOUS FORAGE PLANTS 633.3

1214. 633.3:575(47)
Generalov, G. F. 635.656:575(47)
(New varieties of leguminous crops).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : No. 6 : 20–21.

Descriptions, with indication of their origin, are given of a number of new varieties of peas, vetch and *Lathyrus* distinguished by improved yield, earliness and disease resistance.

1215. 633.3:581.162.31:575.127
Ullmann, W. 633.3:576.312.35
Natürliche und künstliche Bastardierung zwischen Arten und Gattungen der kleeartigen Leguminosen. (**Natural and artificial hybridization between species and genera of the clover-like *Leguminosae*).**
Forschungsdienst 1938 : **5** : 387–426.

The literature on the subject is reviewed and in tabulated form are recorded (I) the natural hybrids between species of clover-like *Leguminosae*; (II) artificial hybridization between species of the clover-like *Leguminosae*, and (III) the chromosome numbers of the species *Ononis, Trigonella, Melilotus, Medicago, Trifolium, Anthyllis, Hymenocarpus, Securigera, Lotus, Dorycnium, Galega, Caragana, Astragalus, Oxytropis, Glycyrrhiza, Colutea, Lespedeza, Ornithopus* and *Onobrychis*. The bibliography covers nearly 12 pages.

1216. Wipf, L. and
Cooper, D. C. 633.3:581.43.071:576.356.5
Chromosome numbers in nodules and roots of red clover, common vetch and garden pea.
Proc. Nat. Acad. Sci. Wash. 1938 : **24** : 87–91.

In 9 nodules on the roots of *Trifolium pratense* L. (2n = 14), the tetraploid chromosome number 28 was consistently found in 28 counts. Only one count in 37, made with 9 nodules of *Vicia angustifolia* L. shewed the diploid number 12, the rest giving the tetraploid number 24. In *Pisum sativum* (2n = 14) the tetraploid number 28 was observed in 51 counts in 8 nodules. One nodule shewed both diploid and tetraploid numbers. The apical meristem of a pea nodule shews a central portion with tetraploid cells surrounded by a diploid cortex. Median sections of the nodule shew a central cylinder of large cells packed with bacteria but there is no evidence of bacteria in the smaller cortical cells. The nuclei of the invaded cells are larger than those of the cortical cells.

It is concluded that in these legumes the infected cells of the nodules are regularly tetraploid and other cases of tetraploidy in galls are cited.

1217. Pohjakallio, O.,
Multamäki, K. and
Nuorvala, S. 633.321:581.162.3:578.08
Puna-apilan jalostus-teknillisiä tutkimuksia. (**Investigations on methods of breeding red clover**).
Valt. Maatalousk. Julk. 1937 : No. 93 : Pp. 66 + 11.

Investigations on the breeding of red clover (*T. pratense*) are in progress in the Plant Breeding Division of the Central Experiment Station, Jokioinen, and the present report deals with pollination and in particular the results obtained when various species of bees were used. None of the red clovers tested was self-fertile. The use of bumble bees that had been washed free from foreign pollen is recommended as the best method of cross-pollinating red clovers. Other methods are also mentioned. J. S.

1218. Hackbarth, J. 633.367:575.11:576.3
Cytologie und Vererbung bei den Lupinenarten. (Sammelreferat). [**Cytology and genetics in lupin species. (Collected bibliography)**].
Züchter 1938 : **10** : 33–41.

The cytology includes work on the chromosome numbers of 21 species of lupin from the old world and the new.

The work of investigators on the genetics of *L. angustifolius, L. luteus, L. albus* and *L. mutabilis* is reviewed. Hardly any genetical work has been done on the other species.

1219. Sengbusch, R. von 633.367:575.11.061.5:581.48
Die Vererbung der Eigenschaft "Weichschaligkeit" bei *Lupinus luteus* und die Auffindung von "weichschaligen" Formen bei *Lupinus angustifolius*. (**The inheritance of the "soft-skinned" character in *L. luteus* and the discovery of "soft skinned" forms in *L. angustifolius***).
Züchter 1938 : **10** : 42–43.

A strain of hard-skinned, alkaloid-free, dark-seeded plants, *WsH* was crossed with one containing alkaloid but soft-skinned and with light seeds *wSh*. The F_1 was hard-skinned, dark-seeded and contained alkaloid, the soft-skinned character is therefore recessive and in the F_2 the ratios confirmed a simple tri-factorial segregation.
A combination of soft-skinned alkaloid-free lupins is therefore possible.
Soft-skinned forms have also been found in *L. angustifolius* and crosses are to be made to combine this with the character alkaloid-free in this species.

1220. Sengbusch, R. v. 633.367:581.192.6:575
Bitterstoffarme Lupinen III. (**Lupins with low alkaloid content III**).
Züchter 1938 : **10** : 91–95.

The strains of so-called sweet lupins from *Lupinus luteus, L. angustifolius* and *L. albus* all shew traces of alkaloid and the last two a greater or lesser decrease in fertility. Observations have shewn that late sowing and dry weather conditions reduce the fertility.
The suggested genetical causes of the disturbances in fertility are either that various genes are linked, of which some are concerned with fertility and others with low alkaloid content, or that one gene causes freedom from alkaloid and low fertility.
In the first case the examination of large numbers of progeny from crosses between low alkaloid content strains with disturbed fertility and bitter strains with normal fertility may reveal plants in which the linkage is broken.
In the other case it is necessary to find a strain with a new gene for low alkaloid content that is not linked with low fertility.
Numbers of plants of all three species of *Lupinus* from different parts of the world were examined and a large number of forms with a low alkaloid content were found, and it is hoped that among these a new gene for more complete alkaloid freedom may be discovered and that it also does not reduce the fertility.

1221. Senn, H. A. 633.378:576.312.35
Experimental data for a revision of the genus *Lathyrus*.
Amer. J. Bot. 1938 : **25** : 67–78.

A consideration of the geographical distribution of the genus leads to the conclusion that the Mediterranean region is the primary centre of origin, with secondary centres in the Western United States of America and in the Chile–Argentine region of South America.
With 17 species of *Lathyrus* and *Pisum sativum* 458 attempts were made at interspecific and intergeneric crosses, but no hybrids were obtained.
The chromosomes, floral characters and epidermal cells of species in the different sections of the genus were studied. The information given on the chromosomes is summarized below, the following abbreviations being used: L = long, M–L = medium long, S = short, M = median, referring to the position of the centromere constriction, S–M = sub-median:— Section *Cicercula* Moench, *L. annuus* L. n = 7, 2n = 14, (2L,M, 2L, S–M, 2M–L, M & 1 M–L, S–M), *L. Acera* L n = 7, 2n = 14, *L. hirsutus* L. 2n = 14, *L. numidicus* Batt., n = 7, 2n = 14: some irregularities were noted in the meiosis of one culture of this species; *L. sativus* L. n = 7, 2n = 14. Section *Eulathyrus* Ser., *L. cirrhosus* Ser., n = 7, *L. heterophyllus* L., 2n = 14, (3L, S–M, 1L, S–M, 1L, S–M with a secondary constriction in the shorter arm, 1 M–L, S M & 1 S,M); one culture of this species had irregular meiosis and low fertility; *L. grandiflorus* Sibth. and Sm., 2n = 14, *L. latifolius* L. n = 7, 2n = 14, *L. sylvestris* L. n = 7, 2n = 14 (1L, M, 1L, S–M, 1L, S–M with a secondary constriction in the shorter arm, 2M–L, M & 2 S,M), *L. odoratus* L. n = 7, 2n = 14 (3L, S–M, 2 M–L, S–M & 2 S,M), *L. tingitanus* L, n = 7, 2n = 14 (1L,M,1L, S–M, 3 M–L, M & 1 M–L, S–M).* *L. tuberosus* L. n = 7, 2n = 14 (1 L, S–M with

* One pair has apparently been omitted by the author.

a secondary constriction in the longer arm, 4 M–L, S–M, & 2 M–L, M). Section *Aphaca* Tourn., *L. Aphaca* Tourn., n = 7, 2n = 14 (2 L, S–M, 2 M–L, M,2,M–L, S–M & 1 S,M). Section *Nissolia* Tourn., *L. Nissolia* L., 2n = 14 (3 L, S–M, 2 M–L, M & 2 M–L, S–M). Section *Clymenum* DC., *L. Clymenum* L., n = 7, 2n = 14, *L. articulatus* L. 2n = 14, *L. Ochrus* DC., n = 7, 2n = 14; these three species each have two pairs of short chromosomes. Section *Ordbastrum* Gren. & Godr. *L. japonicus* Willd. (*L. maritimus* Bigel.) 2n = 14 (1 L, M, 2 L, S–M, 3 M–L, M & 1, S,M) *L. palustris* L., n = 7, *L. ochrolencus* Hook., 2n = 14, *L. venosus* Muhl. n = 14, 2 n= 28: this American species is the only polyploid form encountered; univalents were observed in some cells at meiosis and fertility was low; *L. setifolius* L., n = 7, *L. sphaericus* Retz., n = 7, *L. inconspicuus* L., 2n = 14, *L. nigrivalvis* A. Burkart, n = 7, 2n = 14. Section *Orobus* (Tourn.) Taubert, *L. niger* (L) Bernh., n = 7, 2n = 14, *L. vernus* Bernh., 2n = 14 (1 L, S–M with a secondary constriction in the longer arm, 3 L, S–M, 1 M–L, M & 2 S,M). The following species with 14 somatic chromosomes have not yet been assigned to any section of the genus: *L. crassipes* Gillies, *L. dumetorum* Philippi, *L. macropus* Gillies, *L. paranensis* A. Burkart, *L. Parodii* A. Burkart *L. quadrimarginatus* Bory and Chaub. and *L. sessilifolius* Hook. and Arn.

ROOTS AND TUBERS 633.4

1222. Haga, T. 633.42:576.356.5

Relationship of genom to secondary pairing in *Brassica*. (A preliminary note).

Jap J. Genet. 1938 : **13** : 277–84.

Secondary pairing was studied in the pollen mother cells of *B. nigra* (n = 8), *B. oleracea* (n = 9) and *B. juncea* (n = 18), the maximum associations of bivalents observed being considered to be 2(2) + 4(1) in *nigra*, 3(2) + 3(1) in *oleracea* and 5(3) + 3(1) in *juncea*. Associations of higher orders were observed, but were taken as representing accidental adherence. In the discussion the author presents his conception of the different genoms in *Brassica*. *B. Rapa* (n = 10) has the *a*-genom, AABBCCDDEF, *B. oleracea* has the *b*-genom AABBCCDEF and *B. nigra* the *c*-genom ABCDEEFF, *B. juncea* is then an amphidiploid combining the *a* and *b* genoms. There is a certain amount of homology between the different genoms, due to their being derived by secondary balance from the ancestral genom of 6 chromosomes.

1223. 633.42–2.411.1–1.521.6:575(48.5)

Hertzman, N. 633.42 Immuna, strain 8

Weibulls Immuna rova, stam 8. En mot klumprotsjuka mycket motståndskraftig sort. **(Weibull's Immuna turnip, strain 8. A variety very resistant to club root).**

Weibulls Ill. Årsb. 1937 : **32** : 22–25.

Immuna, from a cross between Ped. Bortfelder and the Naepe turnip Marienlyst V is described. Its resistance to club root has been tested over a four year period and found to be thoroughly satisfactory.

1224. Avanzi, E. 633.491:575

Contributo al miglioramento della patata. **(A contribution to the improvement of the potato).**

Ital. Agric. 1938 : **75** : 7–20.

Researches were undertaken from the end of 1930 for the selection of varieties best adapted to cultivation and for the organization of centres for the reproduction of tubers to substitute, at least in part, those exported from abroad.

A table gives the yield of 34 varieties over a 5 year period, all of which shew a marked degeneration. Selection from the best types failed to prevent the degeneration of the progeny. Finally seedlings were grown both from varieties and crosses including some South American varieties. Details are given of the methods for obtaining seed and for raising the seedlings. The next stage will be the investigation and selection of the progenies.

1225. KRANTZ, F. A. 633.491:575(77.6)
Progress in breeding potatoes suitable for peat land.
Trans. Ia Hort. Soc. 1935 : **70** : 316–17.
In this brief account of work at the University Farm, St. Paul, Minnesota the seedling Minn. 35–26 is mentioned as a promising variety produced by a cross between Rural New Yorker and a white-tuber seedling of Early Ohio (cf. also Abst. 1228). Work is also in progress on the development of an early, scab-resistant variety producing fancy table potatoes. Breeding experiments with frost-resistant South American potatoes are in progress to determine the possibility of transferring this character.

1226. KRANTZ, F. A. and 633.491:575(77.6)
TOLAAS, A. G. 633.491 Mesaba
The Mesaba potato.
Amer. Potato J. 1938 : **15** : 89–91.
A description of the new variety Mesaba is given. Mesaba was bred by the Minnesota Agricultural Experiment Station in co-operation with the United States Department of Agriculture, from a cross between the Russet Rural and a seedling selection, 41–1, from the Early Ohio variety. It is similar to Irish Cobbler in maturity and yield and produces round white tubers of the smooth Rural type. Inoculations with mild and with crinkle mosaic produced little or no noticeable effect.

1227. 633.491:575(77.6)
633.491:575.252.061.6
TOLAAS, A. G. 633.491 Red Warba
The new and newer varieties of potatoes.
Trans. Ia Hort. Soc. 1936 : **71** : 303–05.
A short discussion of some new varieties produced by the Minnesota Experiment Station. The seedling 35–26 is very promising in many respects but its susceptibility to latent mosaic rules it out as a commercial variety. Seedling 5.33–5.34 (Warba x Katahdin) is white in colour, round, with relatively shallow eyes; it is of a much better type than Irish Cobbler and is some 15 to 25 days earlier. Seedling 41.32–1.34 (Katahdin x 11–1) is of an excellent type and matures at about the same time as Cobbler. Seedling 1.33 -2.34 also matures about the same time as Cobbler and has a faint pink colour. It is a Rural type and does well on peat soil. Red Warba is a sport from Warba which it resembles in all respects but its red colour.

1228. ERWIN, A. T. 633.491:575(77.7)
New varieties of potatoes for the corn belt.
Trans. Ia Hort. Soc. 1935 : **70** : 277–83.
It is mentioned that the Iowa Agricultural Experiment Station has participated since 1930 in the United States Department of Agriculture potato breeding project. Seedlings are grown from seed produced in northern Maine and north-eastern Minnesota. The following named seedlings produced by this Federal project are briefly described: Katahdin, Chippewa, Golden and Warba. Minnesota 35 -26 is also mentioned as a very promising seedling (Cf. Abst. 1225).

1229. OKABE, S. 633.491:575.127.2:576.312.35:576.356
[**Plants with a chromosome number of 2n = 48 which occurred in *Solanum guineense* LAM (2n = 72) × *S. nigrum* L. (2n = 72)**].
Jap. J. Genet. 1937 : **13** : 252–53.
Five flowers of *S. guineense* pollinated by *S. nigrum* yielded one seed, from which a plant with 2n = 48 chromosomes was obtained. The problem of the origin of such plants might be approached by a study of (1) fertilization and subsequent embryonic development; (2) the characters of parents and progeny; (3) chromosome conjugation during the reduction division. The author deals with the aspects under (2) and (3).

S. guineense is, in general, a larger plant than *S. nigrum* and has larger leaves and fruits. Both species have white flowers. The F_1 resembled the maternal parent in all respects except size, which was somewhat reduced, probably owing to the small number of chromosomes. The cells of the hybrid were smaller than those of either parent.
During conjugation bivalents and univalents were formed, the lowest number of bivalents being 15 and the highest 22, while the most frequent classes were 17–20.
It is suggested that the haploid genoms of *S. nigrum* should be expressed by the formula AA'B and the constitution of the hybrid in question should be AA'BB. A certain relationship appears to exist between the haploid of *S. nigrum* and of *S. guineense* x *S. nigrum* as regards chromosome conjugation since the above number of bivalents, 17–20, is similar to that in *S. nigrum* + 12—an observation that can be explained by assuming the addition in some way of a B genom. The author's interpretation is that one genom has been duplicated during parthenogenesis following stimulation by the male gamete.

1230. Oláh, L. von 633.491:575.127.2:576.354.4
Cytogenetische Untersuchungen in der Gattung *Solanum*, Sect. *Tuberarium* III. *Solanum commersonii* Dun. und einige seiner Bastarde. (**Cytogenetical investigations on the genus *Solanum* Sect. *Tuberarium* III. *S. commersonii* Dun. and some of its hybrids**).
Z. indukt. Abstamm.- u. VererbLehre 1938 : **74** : 228–41.
The material investigated was *S. commersonii* (2n = 36), *S. chacoense* (2n = 24), *S. spec.* "papa chusa" (2n = 24), *S. henryi* Buk. and the hybrids of *S. commersonii* with *S. henryi*, *S. chacoense* and *S. spec.* "papa chusa".
Details are given of the meiosis of *S. commersonii* and the conclusion is reached that in this triploid species three homologous genoms are united. Restitution nuclei were frequently formed. The irregularities of meiosis lead to the formation of pollen dyads, triads, pentads and hexads as well as the normal tetrads. A large proportion of the pollen was not capable of germination. In the hybrids with *S. chacoense* and *S. spec.* "papa chusa" as the male diploid parents the chromosome numbers were almost exclusively 30–34. The hybrids of *S. henryi* had mostly 24–27 chromosomes, but one plant with 37 and one with 48 were observed.
S. henryi therefore shews a close resemblance to *S. commersonii*, not only in external morphology but also in the constitution of its genes.

1231. Lamm, R. 633.491:576.356.52:581.481
Notes on a haploid potato hybrid.
Hereditas, Lund 1938 : **24** : 391–96.
In the progeny of a tetraploid F_1 hybrid between triploid *Solanum chaucha* and tetraploid *S. tuberosum* there were obtained a pair of twin seedlings, one with 48 chromosomes (tetraploid) and the other, which is the haploid referred to, with 24. In the 48-chromosome twin plant, as in the F_1 hybrid, univalents, bivalents, trivalents and quadrivalents were observed at meiosis. In the 24-chromosome twin 12 bivalents were found in most pollen mother cells and meiosis was regular. Only 9 per cent good pollen was produced, however, as compared with 50 per cent in the tetraploid.
The 24-chromosome plant produced a tuber in its first year and flowered in the second. Its leaves were thinner and more slender than those of the tetraploid and its pollen grains and stomata were smaller.

1232. Odland, M. L. 633.491:581.142
Immediate germination of certain selfed and hybrid potato seed.
Amer. Potato J. 1938 : **15** : 67–71.
Data are presented to shew that genetically different samples of recently harvested seed shew different degrees of delayed germination. Some samples completed their germination within 30 days, in others germination continued up to 90 days. Seed a year or more old may exhibit delayed germination and in seed of a certain selfed line the interval between harvesting and sowing was not found to have any demonstrable influence on the time required for complete germination.

1233. GEYER, H. 633.491–1.531.12:575
Vordringliche Aufgaben der Pflanzenzüchter zur Verbesserung des Pflanzgutwertes bei Kartoffeln. (**Pressing problems for the plant breeder in the improvement of the quality of the planting material in potatoes**).
Forschungsdienst 1938 : **5** : 330–33.

The need for improvement of the material available to the German cultivator of potatoes is stressed and the methods for this improvement are described. The breeder should aim at the production of absolutely healthy planting material.

1234. KÖHLER, E. 633.491–2–1.521.6:575
Widerstandsfähigkeit von Kartoffelsorten. (**The resistance of potato varieties**).
Umschau 1938 : **42** : 123–25.

A brief account of results already achieved in breeding varieties of potato resistant to wart (*Synchytrium*), virus diseases, blight (*Phytophthora*), scab (*Actinomyces*) and to the Colorado beetle.

1235. *PUŠKAREV, I. I. 633.491–2.411.4–1.521.6
(**The new blight-resistant potato variety 8670**).
Novoe v Sel'skom Khozjaistve (What is new in agriculture) published by Sel'khozgiz, Moscow 1937 : No. 6 : Pp 46.

The new potato variety, a hybrid from crosses of *S. demissum* with domestic varieties, is described. It remained perfectly healthy under conditions of artificial infection with *Phytophthora*, which produced an almost complete decay of the varieties Epicure and Wohltmann. The tubers, too, are much less susceptible than in other varieties. In yield the variety is equal to Early Rose, the tubers are large and of good shape, though slightly purple in colour. The stolons are also somewhat too long. The starch content is average and the flavour good; the cut tubers, moreover, do not turn black. Finally, the variety is frost-resistant, tolerating frosts of –3 to –5° C. Its frost and blight resistance the variety has inherited from *S. demissum*, which was one of its parents.

The value of various potato species in breeding for blight resistance is discussed. The hybrids of domestic potatoes with *S. acaule* have unexpectedly shewn an almost complete immunity to *Phytophthora*, although neither of the parents was resistant; they also proved resistant to black leg as well as to frost, and *S. acaule* is therefore regarded as a promising species for crossing.

The domestic x *ajuscoense* hybrids are self-sterile and have 72 chromosomes, in spite of the fact that both parents had 48. Nearly all the hybrids are susceptible to blight, and this cross is not regarded as very promising.

Many of the hybrids of *S. Antipoviczii* are blight resistant and also contain 72 somatic chromosomes, apparently as a result of duplication of the *Antipoviczii* complement. They do not segregate in the later generations and are not regarded as particularly hopeful.

The most promising parent is *S. demissum*, which has, moreover, been found to be resistant to the Colorado beetle as well as to blight and frost. The species consists of a large number of different forms, varying in genetic constitution as regards blight resistance and other characters. Comparisons have been made between the second generation hybrids obtained by selfing and by back-crossing; as regards the proportion of early forms, short stolons, yield, size of tuber and frost resistance, the selfed progenies proved definitely superior. The blight resistance on the other hand was greater in the back-crosses. Here the number of blight-resistant segregates was more than 10 times larger when the F_1 was used as female parent than when it was used as pollen parent. The yield and size of tubers on the other hand were less. The explanation given by Nikolaeva for this difference is that *demissum* chromosomes are eliminated when pollen of the hybrid is used but not in the hybrid egg cells. This interpretation is shewn to be not entirely satisfactory, e.g., the superiority of the selfed progeny as regards frost resistance. Since the number of blight-resistant segregates is fairly high even in the selfed progenies selfing is recommended as the most suitable way of producing

* An extended summary of this paper is on file at the Bureau.

the second generation. The second generation plants may then be intercrossed. Some guidance for making these crosses is given; e.g., tuber formation in the hybrids is of three distinct types: (1) tubers few but very early; (2) tubers very late; and (3) tubers though formed late develop at a great pace. It seems probable that the first type has inherited the indifference to length of day from *tuberosum* and the low yield from *demissum*; the third group has the high yield of *tuberosum* and the short photoperiod of *demissum*, in consequence of which tuber formation begins only in the autumn. From this the suggestion arises that if blight-resistant seedlings of the two opposing types were intercrossed, resistant segregates of good yielding capacity should be produced. This supposition was borne out by the results of crosses involving varying combinations of the different types. From 23 crosses of the types (1) x (3) two seedlings combining high yield and blight resistance have been obtained, and from crosses of this type on a larger scale 107 promising resistant seedlings were selected in 1936, some of which shewed signs of being early croppers.

1236. Lehmann, H. 633.491–2.411.4–1.521.6:575
Geschichte und Ergebnisse der Versuche zur Züchtung krautfäulewiderstandsfähiger Kartoffeln. (**History and results of the researches in breeding potatoes resistant to *Phytophthora***).
Züchter 1938 : **10** : 72–80.

The history of breeding for resistance to *Phytophthora* includes a brief account of the first recognition of the disease and the epidemics which stimulated the search for resistant varieties. One of the most striking results of these researches was the production of the "W" races of Müller and the subsequent disaster in 1932, when a new biotype of the fungus arose to which these races were susceptible.

Interspecific crossing with some of the immune wild races from Mexico and South America is still being pursued but many difficulties have to be overcome. Intraspecific crossing is proving a promising method of attack. In this case immunity is recessive, in interspecific crosses it is dominant.

In conclusion the importance is pointed out of a thorough knowledge of the original material, a really satisfactory method for the selection of resistant types, and the need for a systematic carrying out of the breeding methods. The occurrence of biological races of the fungus has complicated the breeding work and intensive scientific research is needed to gain control of the situation.

1237. Köhler, E. 633.491–2.8–1.521.6:575
Viruskrankheiten und Kartoffelzüchtung. (**Virus diseases and potato breeding**).
Forschungsdienst 1938 : **5** : 334–38.

Two questions are considered in this lecture. One is how to maintain virus-free stocks of potato and the second how to breed resistant varieties.

The methods for keeping the plants free from *Myzus persicae*, the vector of the two most feared virus diseases are discussed. There are two forms of resistance, one in which the plants definitely repel infection, and tolerance, in which the plant is infected but not injured. This later form constitutes a danger as from it sound plants can be infected.

Some varieties of the cultivated potato do possess genes for resistance, but very few shew resistance to both leaf roll and streak mosaic. Such are Parnassia, Flava, Feuergold and Jubel, but much work in this direction remains to be done.

FIBRES 633.5

1238. Chevalier, A. 633.51 *G. barbadense* L. var. *Marie-Galante*
Le cotonnier sauvage (?) de *Marie-Galante*. [**The wild (?) cotton of *Marie Galante***].
Rev. Bot. Appl. 1938 : **18** : 115–18.

An examination of plants and herbarium material of the species described by Watt as *Gossypium Marie-Galante* shewed such close resemblances to *G. barbadense* L. var. *maritima* Watt that it is regarded as a special race and named *G. barbadense* L. var. *Marie Galante* (Watt) A. Chev.

1239. Ware, J. O. 633.51(73)
Some notes on the origin of cotton varieties in the United States.
Proc. 37th Annu. Convent. Ass. S. Agric. Wkrs, Jackson, Miss., 1936 (1937) : 55–56. (Abst.)
The varieties of cotton in the U.S.A. may be divided into three groups: Sea Island, Upland and American-Egyptian.
The history of the introduction of these 3 types into the States and the origin of the present varieties by breeding and selection is traced.

1240. Neely, J. W. 633.51:575
Recent genetic and breeding studies in cotton.
Proc. 38th Annu. Convent. Ass. S. Agric. Wkrs, Jackson, Miss., 1937 : p. 207. (Abst.)
The following lines for future work are suggested: continuing the well-established selection programmes, which have produced most of the improved strains; exhaustive study of intra-specific inheritance; study of inheritance of interspecific crosses; extensive and systematic crosses between varieties, between New World species and between Old and New World species and, finally, the use of the back-cross method.

1241. Kulebjaev, V. 633.51 *G. barbadense*:575.061.1
(Something new in Egyptian cotton breeding).
Sotsialističeskaja Rekonstruktsija Sel'skogo Khozjaistva (Socialist Reconstruction of Agriculture) 1937 : No. 2 : 227–30.
Two Ashmouni selections with short internodes were used in crossing for the production of a form with compact habit. In the F_3 there appeared certain plants with zero branching, i.e., with bolls formed direct in the leaf axils of the main stem, the stem internodes being unusually short; the resulting plant is thus extremely compact. The general characteristics of the plants are described; in one plant the total vegetation period from sowing to maturity was 138 days, yield per plant 84·7 grm., lint length 36–38 mm., ginning out-turn 35 per cent. In another the vegetation period was 140 days, lint length 38–40 mm., yield per plant 73·7 grm. and ginning out-turn 34 per cent. These hybrids are thought to be promising on account of the greater density of sowing that they will permit, combined with their suitability for mechanical harvesting.

1242. Cotton, J. R. 633.51:575.242
Notes on the appearance and behavior of a peculiar new strain of cotton.
Proc. 37th Annu. Convent. Ass. S. Agric. Wkrs, Jackson, Miss., 1936 (1937) : 57–58. (Abst.)
A description is given of an aberrant plant which appeared in 1930 in a block of Express cotton. It has rounded leaves instead of the usual lobed type and many other unusual features. The progenies raised from it in 1931 and subsequent years bred true to the aberrant type. The normal Upland type is occasionally produced on an aberrant plant as a bud sport, but selfed seed from the Upland branches produce only round-leaved plants which breed true. The aberrant type is believed to be a mutation and is to be studied further. Its somatic chromosome number is 52 or thereabouts. (Cf. "Plant Breeding Abstracts", Vol. VII, Abst. 1300).

1243. 633.51:575.42(67.5)
La sélection et la multiplication des graines de coton à Bambesa (Inéac).
[**The selection and multiplication of cotton seed at Bambesa (Inéac)**].
Agric. Élev. Congo Belge 1937 : **11** : 114–15.
This article contains summaries of various papers and reports already reviewed (see "Plant Breeding Abstracts", Vol. VII, Absts. 1007, 1008 and 1304).

1244. Kearney, T. H. 633.51:581.9
Relationships of the cultivated and wild cottons of the world.
Proc. 37th Annu. Convent. Ass. S. Agric. Wkrs, Jackson, Miss., 1936 (1937) : 56–57. (Abst.)
The difficulties of a satisfactory botanical classification of cottons are emphasized. It is suggested that the cultivated cottons are of hybrid origin, derived from more than one wild species.
A system of classification following Harland's in its main outlines is proposed. Three sections of the genus *Gossypium* are recognized: (1) Lint-bearing New World species with 26 haploid chromosomes; (*a*) the Mexican-Central American cottons represented by Upland (*G. hirsutum*), (*b*) the South American cottons represented by Sea Island and Egyptian (*G. barbadense*) and the Peruvian tree cottons (*G. peruvianum*), and (*c*) certain species now found wild in Polynesia and the Galapagos Islands but which may have been cultivated formerly; (2) Old World cottons with 13 haploid chromosomes, (*a*) cultivated Asiatic species, and (*b*) 3 wild species found in south-eastern Asia, tropical Africa and Australia respectively; (3) Lintless American wild species with 13 haploid chromosomes, comprising 5 species, one in southern Arizona, three in the Gulf of California region and one in the Galapagos Islands.

1245. Pope, O. A. and
Ware, J. O. 633.51–1.421:519.24
Analysis of variance as applied to the Regional Cotton Variety Study.
Proc. 37th Annu. Convent. Ass. S. Agric. Wkrs, Jackson, Miss., 1936 (1937) : p. 60. (Abst.)
In a variety test carried out at four locations it was found that there was, in the combined test, slightly more than a 50 per cent reduction in the error variance due to the restricted random arrangement and the method of analysis of the data.

1246. Kreibohm de la Vega, G. A. 633.51–2.7–1.521.6:575
Contribución a la lucha mecánica contra algunos enemigos del algodonero mediante la formación de variedades adecuadas. (**Contribution towards the mechanical control of certain cotton pests by the production of suitable varieties**).
Rev. Industr. Agric. Tucumán 1937 : **27** : 99–103.
Two new varieties, Sirigi from Alagoas, Brazil, and Hoja Digitada, an Acalá from Chaco, are being intercrossed in the attempt to produce a cotton whose flowers and fruits are free from enclosing leaves, thus allowing the direct penetration of arsenical sprays used in combating various insect pests.

1247. Pope, O. A. 633.51.00.14(73)
A study of certain phases of a regional study of cotton varieties.
Proc. 38th Annu. Convent. Ass. S. Agric. Wkrs, Jackson, Miss., 1937 : 207–08. (Abst.)
In this study 8 replications of 16 varieties are being grown at 14 locations over a period of 3 years. Over 60 variables are being studied, including time from planting to emergence, flowering and opening, boll census, yield, disease, ginning data, colour, staple length, tensile strength distribution and spinning value. From the first year's data it appears that length, fineness, seed index, lint index and percentage of lint are largely determined by genetical constitution, while yield, maturity of fibre, strength and time from planting to emergence, flowering and opening are modified to a considerable extent by environmental conditions.

1248. Bredemann, G. 633.522:575.42
Züchtung des Hanfes auf Fasergehalt. Die Ergebnisse des Jahres 1937. (**Breeding hemp for fibre content. The results of 1937**).
Faserforschung 1938 : **13** : 81–87.
The selection of male and female plants for the highest fibre content is continued (Cf. "Plant Breeding Abstracts", Vol. VIII, Abst. 560) and the results of crossing are recorded. These shew the remarkable increases obtainable by this method.

1249. Bredemann, G. 633.525.2:575
Die Nessel als Faserpflanze. (**The nettle as a fibre plant**).
Forschungsdienst 1938 : **5** : 148–61.
More than eighteen years of breeding work on the nettle *Urtica dioica* L. has raised the fibre content from 3 per cent to 13 per cent, and the fibres can be profitably used as a supplement to cotton. The cultivation of the plant is described.

1250. Inariyama, S. 633.526.2:576.312.35:576.354.4
Karyotype studies in *Amaryllidaceae* 1.
Sci. Rep. Tokyo Bunrika Daig. 1937 : **3** (No. 52) : Sect. B : 95–113.
Studies on 39 species are reported, including the following *Agave* species:—*A. angustifolia* Haw. 2n = 60 with 10 long chromosomes; *A. candelabrum* Todaro (= *A. cantala*) 2n = 90 with 15 long chromosomes; *A. americana* L., *A. americana* L. var. *variegata* and an undetermined species, 2n = 120, with 20 long chromosomes; *A. sisalana* Perr. 2n = 150 with 25 long chromosomes. Meiosis was studied in *A. americana* var. *variegata*, where quadrivalents were observed and in *A. sisalana*, where uni-, bi-, tri-, quadri- and quinquivalents were seen. *Fourcroya gigantea* Vent. was found to have 2n = 60, with 10 long chromosomes.

1251. Håkansson, Å. 633.584.3:575.127.2:576.356.5
Zytologische Studien an *Salix*-Bastarden. (**Cytological studies on *Salix* hybrids**).
Hereditas, Lund 1938 : **24** : 1–32.
In the F_2 of the cross *Salix viminalis* x *caprea* about 1 per cent of triploids appear, though both parents are diploid (2n = 38). Trivalents, bivalents and univalents were found at metaphase I in the triploids and first and second anaphases were in consequence irregular. The male triploids formed rather more trivalents than the females. There also appeared in the F_2 of this cross a shrub very similar to the tetraploid species *S. cinerea*. This shrub was tetraploid, with a regular meiosis, though 1 to 3 multivalents were frequently observed. When a triploid hybrid was back-crossed as pollen parent to *S. viminalis*, three triploids, two diploids and one aneuploid were obtained, the aneuploid having 41 somatic chromosomes and irregular meiosis.
Regular meiosis, with 19 bivalents was observed in the diploid hybrids *purpurea* x *hastata*, *aurita* x *hastata*, *repens* x *viminalis*, *viminalis* x *aurita* and *viminalis* x *daphnoides*. The diploid hybrid (*purpurea* x *daphnoides*) x (*repens* x *aurita*) also had regular meiosis and mostly 19 bivalents.
The tetraploid hybrid *S. viminalis* (n = 19) x *S. phylicifolia* (n = 57) had regular meiosis, very often with 38 bivalents, more rarely one or more multivalents. This autosyndesis of *phylicifolia* chromosomes suggests a high degree of autopolyploidy.
The octonary hybrid already described (Cf. "Plant Breeding Abstracts", Vol. VIII, Abst. 933) was found to be tetraploid, with very regular meiosis and often 38 bivalents.
The following triploid hybrids of the tetraploid *S. cinerea* were studied: *repens* x *cinerea*, *viminalis* x *cinerea*, *caprea* x *cinerea*, *aurita* x *cinerea* and (*viminalis* x *caprea*) x *cinerea*. Meiosis was irregular and the proportion of trivalents was less than in the triploids from *viminalis* x *caprea* mentioned above and the number of univalents greater, which is taken to indicate a certain amount of structural differentiation between the two genoms of *S. cinerea*. The pentaploid hybrid *cinerea* x *phylicifolia* had an irregular meiosis with many univalents and rather few multivalents. In the female plants of *cinerea* hybrids the development of the megaspore mother cell was greatly retarded in relation to the vegetative development of the ovule.

SUGAR PLANTS 633.6

1252. 633.61(96.9)
An acreage census of cane varieties for the crops of 1936, 1937, 1938.
Circ. Hawaii. Sug. Pl. Exp. Sta. 1936 : No. 69 : Pp. 64.
Extensive data are given on the acreages occupied by the different varieties.

1253. Belcher, B. A. and
Sherwood, S. F. 633.61:575
Two new varieties of sugarcane for sirup production.
Sug. News 1938 : **19** : p. 158.
C.P.20 116 bred by the Bureau of Plant Industry at the United States Sugar Plant Field Station, Canal Point, Fla. and Co. 290, imported from India are two new superior disease-resistant varieties for the production of sugar-cane syrup and are likely to replace P.O.J. 213 and C.P. 807.

1254. Jones, E. 633.61:575(76.3)
The story of the new canes.
Sug. Bull. N.O., 1937 : **15** : No. 24 : 14–18.
An account, from the planter's point of view, of the benefits conferred by the introduction and breeding of new varieties of sugar-cane for Louisiana.

1255. 633.61:575(91.4)
Calma, V. C. 633.61.00.14
Comparative performance tests of three newly developed C.A.C. varieties of sugar cane.
Philipp. Agric. 1938 : **26** : 757–73.
The varieties tested were the Philippine College of Agriculture seedlings C.A.C. 117, 126 and 128, hybrids between P.B. 119 and C.A.C. 87. None of them exceeded the standard varieties in yield of cane or sugar per hectare or sugar per ton of cane, but C.A.C. 117 and 128 are considered to be worth further trial in other districts.

1256. 633.61:575(96.9)
Report of Committee in charge of the Experiment Station Hawaiian Sugar Planters' Association for the year ending September 30th, 1936 : Pp. 143.
Proc. 56th Annu. Mtg. Hawaii. Sug. Pl. Ass. 1936 (1937).
The 1935–36 crossing season was devoted chiefly to crosses between *S. robustum* derivatives and other breeding canes. A total of 2,002 crosses were harvested, of which 553 were controlled bi-parental crosses, 1,218 were "melting pot" crosses (Cf. "Plant Breeding Abstracts", Vol. VII, Abst. 236) to test breeding behaviour and 234 were field crosses collected on the plantations and regional variety stations; 70,333 seedlings were distributed for planting. In general, F_1 hybrids of *robustum* with noble or highly nobilized canes and their first back-crosses to the latter have produced high proportions of attractive types when used as breeding parents. The following, in particular, are especially noteworthy as parents: 32–6774 (POJ 2878 x Molokai 1231), 32 7583 (26C 188 x Molokai 1183) and 33 7099 and 33–7101 (both 27 8101 x 32–7583); Molokai 1231 and 1183 are New Guinea *robustum* types. Other canes outstanding as breeding parents are Co. 290, 28–4867, 31–1389, 31–2687, 31–2806, 31–2904, 32–519 and 32–8560. Badila and Yellow Caledonia have long been recognized as good breeding parents, but Badila rarely flowers on Oahu and Yellow Caledonia is of low fertility; good seedlings of each of these canes, however, are available for crossing.
Ethylene and acetylene are known to induce flowering in the pineapple irrespective of age or season and attempts have been made to apply this method to sugar-cane, so far without success.
Data are given on the performance of a number of selected seedlings at the regional variety stations. The 71 seedlings included in co-operative variety tests on plantations are listed; of these 31–1389 has been included in 39 different tests, 31–1203 in 19 and 31–2538 in 16.
Cytological studies are in progress on the doubling of the maternal chromosomes which occurs when *S. officinarum* is used as female parent in crosses with *S. spontaneum*, *S. Barberi* and *Sorghum*, attention being concentrated at present on the *spontaneum* crosses.
The pathology department is carrying out a test of varietal resistance to leaf scald.

1257. Lauritzen, J. I., Fort, C. A. and Balch, R. T. 633.61:577.15:575
Relative inversion of sucrose in mill and windrowed cane of commercial and seedling varieties in Louisiana.
Sug. Bull. N.O. 1937 : **16** : No. 2 : 5–8.

Data are given shewing the susceptibility to sucrose inversion when windrowed of the principal varieties of sugar-cane now in cultivation in Louisiana and also of a number of Canal Point seedlings of the 1929 series. Co.281 is the least susceptible of the commercial varieties and among the seedlings tested C.P.29/94 and 29/99 are equal or superior to it in resistance to inversion of sucrose; C.P.29/137 in a rather small-scale test proved better than Co.281 in windrowing qualities.

C.P.29/94 is probably too low in sucrose to be a good commercial windrowing cane and C.P.29/99 needs further testing for reaction to red rot. If C.P.29/137 on further testing behaves as it did in the test mentioned above its agronomic and disease-resistant qualities should make it a suitable cane for windrowing. These three seedlings and six others which shewed a fair resistance to inversion all came from the same parents, P.O.J.2725 and C.P.1165.

1258. Yamazaki, M. and Ueno, T. 633.61:581.44:578.081 633.61–2.7–1.521.6
(Measurement of stem hardness of the sugar cane bearing on the study of breeding).
Rep. Jap. Ass. Sci. 1935 : **10** : 845–48.

An instrument has been devised by which the hardness of sugar-cane stems can be determined by registering on a dial the pressure required to pass a rod horizontally through the stem. Since hardness of the stem was proved to be highly correlated with fibre content, the above device should be of value in breeding for reduced fibre content and for resistance to insect injury. Tables are given shewing that hardness of the stem is in inverse proportion to insect injury and damage by a pyralid moth in particular.

1259. Arceneaux, G. 633.61.00.14(76.3)
Variety tests of surgarcane in the southern United States.
Proc. 37th Annu. Convent. Ass. S. Agric. Wkrs, Jackson, Miss., 1936 (1937) : p. 65. (Abst.)

The performance of new varieties is measured in a continuous series of tests in Louisiana in 10 selected localities. Cane-yield estimates are based on weight from twelve $\frac{1}{40}$ acre plots of each variety at each locality. Indicated varietal yields of sugar per ton of cane are calculated from average juice analyses of twelve samples, each consisting of 40 stalks from individual plots of the locality test. It is usually possible to measure differences of 10 per cent in yield and of 5 per cent in indicated yield of sugar per ton of cane.

A brief account of the varieties grown for sugar is given (Cf. "Plant Breeding Abstracts", Vol. VIII, Abst. 892) and it is mentioned that Cayana (*Saccharum sinense*), P.O.J.213, C.P.807 and Co.290 are now extensively cultivated in the syrup-producing areas of the southern U.S.A.

1260. 633.63:575
Surmann, M. 633.63:575.125
Wege zu neuen Erfolgen in der Zuckerrübenzucht. **(Ways and means towards new results in sugar beet breeding).**
Zb. Zuckerindustr. 1938 : **46** : 69–70.

The problems and aims of the breeder of sugar beets are briefly noted. Many valuable strains resistant to drought, to disease and with a high yield have been bred but it remains to combine these qualities in a single strain without such undesirable characters as bolting, etc. Studies on the results of inbreeding have shewn that there exist lines that do not degenerate after the marked heterosis of the F_1. Further work in this direction is in progress.

1261. 633.63:575:581.08
633.35:575(47)
633.11:575(47)

Samoilov, I. G.
(Results of the work of the L'gov Station).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : No. 6 : 27–31.

Experiments have shewn that the relative value of a number of sugar beet selections varies with the manurial conditions under which they are grown and it has been found desirable to test the lines under as varied conditions as possible before making selections. Figures are also given shewing that if one line is characterized by response to one manurial element and another line to another element, a mechanical mixture of the two will give higher yields than either grown singly. Such lines differing in response were also intercrossed, with the result that yield increases of up to 14 per cent were obtained in the F_1, especially when they were grown with abundant manurial supply.
Similarly, as regards the weight of shoot produced in a given time from germination the varieties assumed different orders according to the temperature at which they were grown; thus some giving the highest weight increase when grown at 10° C. were far behind when grown at 25° C.; such varieties would be suitable for cultivation in cold northern zones. This gives a rapid method of carrying out selection in the early stages.
Again, hardy varieties with a long thermo-stage react to vernalization by an increase in yield but a reduction in sugar content, whereas varieties more responsive to heat, with a shorter thermo-stage, increase their sugar content after vernalization. Crossing these two types is therefore the best method of producing strains combining high yield and sugar content.
Varieties of spring vetch have been produced that give higher fodder yields under conditions of intensive manuring, variety 31–292, produced by individual plant selection from a local plantation being particularly successful in a great number of different neighbourhoods.
Improved varieties of winter wheat have been produced by selection from local populations, yield, winter-hardiness, grain quality and disease resistance being the lines on which the improvement is most marked. Crosses are being made according to the principle of phasic development.

1262. Ginneken, P. J. H. van and
Haan, E. de 633.63:575.42:581.192

De beteekenis van de verhouding van het wortelgewicht tot het gewicht der geheele plant. (**The importance of the relation existing between the weight of the root and the weight of the whole plant**).
Meded. Inst. Suikerbiet. Bergen-o.-Z. 1937 : No. 2 : 27–45.

Determinations in experimental plots of sugar beet have shewn that varietal differences in root weight are much less than the difference in the sugar content and also that a strain which stores in its root a relatively large proportion of total dry matter will very probably have a higher sugar content than strains in which the proportion of dry matter in the root is less. A similar correlation holds for the weight of the root and of the entire plant —a relationship which may also be indicated by a comparative reduction in the number of leaves.
With an increase in ratio of root weight to plant weight the sugar content does not decrease and the plant weight but little or less frequently to any great extent.
In selecting sugar beet for high sugar content the number of leaves produced by the variety in question must be considered.

1263. Krüger, W.,
Wimmer, G. and
Lüdecke, H. 633.63–1.8:581.143.26

Ein beitrag zur Klärung der Ursache von Schossrüben- und Trotzerbildung bei der Zuckerrübe. (**A contribution to the elucidation of the causes of the production of bolters and fizzlers in the sugar beet**).
Z. Wirtschaftsgr. Zuckerindustr. 1937 : **87** : 537–46.

The authors find that excess of available nitrogen in the first year from seed encourages bolting. Deficiency in nitrogen, potassium or phosphate discourages bolting and seedlings raised under

a deficiency of nitrogen often fail to bear seed the following year (fizzlers). Lack of potassium or phosphate has little effect on the production of fizzlers.

1264. Muraviev, V. P. 633.63–2–1.521.6
(Methodics of breeding rot-resistant sugar beet varieties).
Naučnye Zapiski Sakharnoi Promyšlennosti (Sci. Trans. Sug. Ind.) **1937** : **14** : No. 1 : 72–80.

Though no single specific causal organism for root rot of sugar beet has yet been discovered, it is known that only physiologically inferior seedlings are subject to attack by the various organisms (both bacteria and fungi) that appear to be responsible for the disease under various conditions. Hence the environment under which beet seedlings are raised constitutes a highly important factor in the incidence of the disease; and any differences in the reactions of races of sugar beet to environments favourable to the occurrence of root rot must be based, not upon immunity to an organism or organisms but on inherent physiological resistance to such unfavourable conditions. Possible ways of selecting resistant plants are mentioned, and an experiment is described in which the susceptible types were eliminated by subjecting a collection of seedlings raised in pots to a combination of unfavourable environmental factors similar to those under which rot in natural conditions occurs in its most marked form, e.g., defective aeration in a heavy soil with a tendency to become sour and cake. The relative growth vigour of seedlings that break through to the surface under such conditions forms the basis of subsequent selection for root rot resistant plants.
An experimental test of this theory with four varieties shewed that those seedlings which (judged by the above criterion of the relative time of germination) exhibited greater physiological resistance to the unfavourable conditions were also more resistant to disease. From a comparison of the incidence of disease among plants raised from the seed of seedlings selected for their physiological resistance with the incidence among the original plant material, the author concludes that resistance to root rot was inherited and that the technique used may therefore be employed to obtain resistant strains. One operation of selection having resulted in a reduction of 13 per cent in the number of affected plants, repeated selection should, it is claimed, give still better results.

1265. Kikuta, K.
Whitney, L. D.
Parris, G. K. 633.689–1.547.25:575
Seeds and seedlings of the taro, *Colocasia esculenta*.
Amer. J. Bot. **1938** : **25** : 186–88.

The production of seeds and seedlings from the taro variety Eleele Makolo at the Hawaii Agricultural Experiment Station is noted. The seeds are very small and apparently of short viability. It is suggested that taro sets seed more frequently than has been thought and that it may be possible to breed superior varieties.

STIMULANTS 633.7

1266. Moss, E. G. 633.71(75.6)
Flue-cured tobacco varieties.
Proc. 37th Annu. Convent. Ass. S. Agric. Wkrs, Jackson, Miss., **1936** (1937) : 67–68. (Abst.)

Most of the standard varieties and their numerous strains now cultivated in the U.S.A. have probably been derived from the two original varieties Virginia or Orinoco and Maryland Broadleaf. Extensive variety tests during the past 24 years at the Tobacco Station in North Carolina have shewn that many so-called varieties are synonyms. A broad classification into two groups has been made, one including the large, broad leaf sorts and the other the medium broad to narrow forms. In the broad leaf types as a whole there is a greater angle between the midrib and the principal veins and the veins are slightly larger while the web of the leaf is slightly thinner. The six best varieties have been chosen and the seed of these varieties, grown by reputable tobacco growers is certified by the Crop Improvement Association.

1267. 633.71:575(49.7)
(Forty years of work for Bulgarian rural communities 1895-1935).
Bulgarian Agricultural Society, Sofia 1936 : Pp. 101.
In this account of the activities and achievements of the Bulgarian Agricultural Society, brief mention is made of the tobacco-breeding work at Asenovgrad by M. Christov. The improved varieties Ustinski Nos. 1, 2, 4, 17 and 28 have been produced and are grown and distributed by the State Tobacco Experiment Station at Kozarsko.

1268. 633.71:575(72.95)
First Annual Report of the Tobacco Institute of Puerto Rico, 1936-37.
San Juan, P.R. 1937 : Pp. 53.
The founding, organization and aims of the Institute are described. Its work includes the breeding of varieties resistant to black shank disease and to mosaic disease, by hybridization and selection. Although the tobacco industry of Puerto Rico is chiefly concerned with cigar filler tobacco, experiments have been conducted to test the suitability of different varieties for flue-curing and sun-curing, to produce cigarette tobacco. Interspecific crosses are studied, with special reference to resistance to mosaic and black shank. Seed of numerous varieties and species has been imported for testing.

1269. Coolhaas, C. 633.71:575(92.2)
Onderzoekingen over brandbaarheid van tabak II. **(Investigations on fire-holding capacity of tobacco II).**
Meded. Proefst. Vorstenl. Tab. 1934 : No. 79 : Pp. 104.
Methods of determining the fire-holding capacity of tobacco leaf are discussed and attention is finally directed to the principal component of the above-mentioned property, namely the glowing capacity of the ignited leaf as determined by the duration in seconds and termed the glowing period.
Having discussed the findings on defective fire-holding capacity from the standpoints of the chemical composition of the leaf and of the soil, the results of selection work with various lines are reported.
This history of selection for fire-holding capacity in Y 10 is summarized. Since no heritable differences were found, selection has been abandoned by the writer, though it is still being included in work in progress elsewhere.
In the Kanari strains line D (Kanari 1917) the limit of selection has been reached and no further progress can be expected. The line has been named KBS1. In numerous comparative tests with progeny from the E3K crosses, with Y 10, Kanari 493 and others, this KBS1 selection has proved its value as regards fire-holding capacity. The E3K back-cross with Kanari also gave good results.
All the EK crosses shewed a higher average glowing period than other lines. Figures from selection work on various estates indicated that the fire-holding capacity of E3K66 was good but that of E3K113 was inferior and the X-ray mutant, semi-gigas, was somewhat inferior to Kanari.
Observations on variations in fire-holding capacity in E3K66, KW 10 and Y 10 shewed that soil may be an important factor in determining this property.
In future the fire-holding capacity is to be determined from samples of all pedigree lines in test plots of seed plants. From the work with E3K numbers and Kanari 1913 so far selection does not appear to have resulted in genetic differences in fire-holding capacity.
A study of the chemical composition of the leaf in lines characterized by good and bad fire-holding capacity indicated that this latter property was related to the hereditary tendency of the leaf to absorption of chlorine, potassium and magnesium, but further data on this point are necessary.

1270. Bolsunov, I. I. 633.71:575.125
(Studies on the heterosis or growth vigour in *Nicotiana rustica* plants).
Vsesojuznyi Institut Tabačnoi i Makhoročnoi Promyšlennosti Imeni A.I. Mikojana (Vitim) (All-Union Mikojan Institute of the Tobacco and Makhorka Industry) Krasnodar 1936 : 2 : Pt. 132 : 118–28.

In considering the problem of heterosis it is pointed out that environmental factors should also be taken into account. The results of four years' work on the influence of environmental factors, namely temperature, humidity, soil type, ecological conditions and meteorological factors upon heterosis in *N. rustica* are reported. In all cases a marked influence of such factors upon the degree of heterosis was noted, ranging from a 50 per cent increase in productivity to entire absence of hybrid vigour. Hence, in the investigation of this phenomenon the new F_1 genotype must be studied in its reactions to the combination of factors constituting the environment so that the optimum conditions for the maximum increase in productivity of the hybrid as compared with the parents may be ascertained.

1271. Ternovski, M. F. 633.71:575.127.2:576.356.5
(Polyploids and haploids in *Nicotiana* interspecific hybridization).
Vsesojuznyi Institut Tabačnoi i Makhoročnoi Promyšlennosti Imeni A.I. Mikojana (Vitim) (All-Union Mikojan Institute of the Tobacco and Makhorka Industry) Krasnodar 1936 : 2 : Pt. 132 : 59–108.

This paper forms the first of a series of publications to be issued on interspecific hybrids in *Nicotiana*.

The technique used is fully described, and specially the cytological study, in which the writer claims to have used new methods. The terminology of polyploidy is discussed and the definitions and usage advocated by the author are stated for the terms amphidiploid, sesquidiploid, amphihaploid, triploid and tetraploid. A system of notation is adopted in which the chromosome complement of interspecific hybrids is indicated by appending to the chromosome numbers of the parent forms the first letter of the particular parent contributing the genom; the letter is added once or twice, etc., according to the number of times that genom occurs in the hybrid, e.g., the amphihaploid of *N. Tabacum* (n = 24) x *N. glauca* (n = 12) will have the formula $24_t + 12_g$, while sesquidiploids from this cross would be either $24_{tt} + 12_g$ or $24_t + 12_{gg}$, depending on which of the parent species was represented by two genoms.

Cytological data with descriptions of the hybrid phenotypes are given for amphihaploids and sesquidiploids obtained in the F_1 from the crosses *N. rustica* (n = 24) x *N. Tabacum*; *N. rustica* (n = 24) x *N. glauca* (n = 12); *N. Tabacum* x *N. glauca* and *N. Tabacum* x *N. Sanderae* hort (n = 9) and from other crosses too.

Some of these crosses have been obtained by other workers, whose investigations are referred to in the extensive bibliography.

To the *N. rustica* x *N. Tabacum* sesquidiploid the formula $24_r + 24_{tt}$ was assigned. Its reduction division was much less irregular than in the amphihaploid from the same combination and it was fertile, but only in back-crosses with *Tabacum*. The back-cross hybrid again was fertile when crossed with *Tabacum* and a few other species but at the same time was self-sterile. The sesquidiploid origin may have been due to pollination with an unreduced pollen grain or possibly to dispermy in the *Tabacum* parent.

The well known difficulty of obtaining the *N. rustica* x *N. glauca* hybrid is due to some extent, in the writer's opinion, to the use by previous workers of the variety *humilis*, from which the writer obtained only one hybrid in 4 years. Incidentally, certain combinations shewed marked heterosis in plant height, e.g., *N. rustica* var. *Erba santa* x *N. glauca*. Four F_1 sesquidiploids were identified all with the formula $24_r + 12_{gg}$ and 2n = 48. The reduction division was considerably more regular than in the amphihaploid. Pairing may possibly be interpreted as occurring between the *glauca* genoms with partial conjugation of the resulting bivalents with some of the *rustica* chromosomes, the rest of the latter remaining as univalents. The percentage of normal pollen in three sesquidiploids examined varied from 4–18. These hybrids are self-sterile but fertile in open-pollination, and in the back-cross to *N. glauca* and in crosses with *N. Tabacum*, while the back-cross to *N. rustica* is very difficult to obtain. The origin of this hybrid is attributed to reduplication of the chromosomes of the pollen

grains and the success of the cross is believed to be due to using very small quantities of pollen in order to reduce competition among the haploid and diploid grains.
From the cross *N. Tabacum* L. x *N. glauca* Gr. four plants were obtained with the formula $24_{tt} + 12_g$. The reciprocal gave no polyploids and only two *Tabacum* varieties, Dubec Nikitskii 44/39 and American 572 gave sesquidiploids. As before, the reduction division was less irregular than in the amphihaploid. Bivalents, univalents and trivalents were present in the pollen and megaspore mother cells, the most frequent form of pairing among the trivalents being ring formation. The formation of polyploid spores was recorded. Only 23 per cent of the pollen was normal in regard to the content of protoplasm, which was deficient in the majority of cases. No seed was obtained by selfing but the sesquidiploid crossed by the parent forms gave an excellent set and some of the resulting plants were fully fertile; others were quite sterile. In regard to this sesquidiploid, emphasis is laid on the marked parallelism between the variation of the characters of its progeny and the variation in X-ray mutants.
From the cross *N. Tabacum* x *N. Sanderae* (n = 9) six F_1 hybrids were obtained, one of which proved fertile under conditions of open pollination and is regarded on cytological grounds as being of the formula $24_{tt} + 9_s$. Judging from the high percentage of dyads formed during sporogenesis in the amphihaploid from this cross, there exists a marked tendency to the production of sex cells with the reduplicated chromosome number. Eight plants were obtained under conditions of open pollination from the sesquidiploid but they were mainly sterile. A repetition of the cross gave no sesquidiploids.
The back-cross (*N. rustica* L. x *N. Tabacum* L.) x *N. Tabacum* L. also yielded a sesquidiploid (probably $24_r + 24_{tt}$) (Cf. "Plant Breeding Abstracts", Vol. I, Abst. 229) as did also the crosses *N. Tabacum* L. x *N. sylvestris* Speg et Comes) x *N. Tabacum* L.; *N. digluta* x *N. glutinosa*; *N. digluta* x *N. Tabacum*; *N. ditagla* (Cf. below) x *N. Tabacum* and *N. ditagla* x *N. glauca*—all of which were self-sterile, except *N. digluta* x *N. Tabacum* ($12_g + 24_{tt}$), which set a few seeds on selfing. The reduction division and chromosome conjugation is much more regular in these crosses when two *Tabacum* genoms are present.
Nine amphidiploids were obtained among the ten fertile F_1 plants from the *N. glutinosa* (n = 12) x *N. Tabacum* cross, and it is pointed out that such forms, resulting from chromosome doubling relatively late in ontogeny, occur mainly in crosses made in late autumn, when temperatures are low. An amphidiploid that originated by somatic mutation is also described.
Two amphidiploid plants were obtained from the cross *N. Tabacum* L. x *N. glauca* Gr., both being fertile under conditions of open pollination and of isolation. In one of these plants, H.363–1, the amphihaploid number of chromosomes was found in some of the root tips, chromosome doubling apparently having occurred late in ontogeny. The F_2 of about 600 plants was highly uniform, with the exception of two sterile haploids derived from H.363 1. The third and fourth generations were also highly uniform. To this new and highly constant, vigorous and luxuriant form, which is perennial in habit, the author has given the name *N. ditagla*. It is fertile with many other *Nicotiana* species but the relevant data on its crossability have not been published.
An amphidiploid arising in the F_2 of *N. Tabacum* L. x *N. glauca* Gr. is also described.
The large number of polyploids obtained in the investigation reviewed is attributed to (1) the large scale of work on the F_1 hybrids and also the relatively high frequency of chromosome doubling in sporogenesis of the parent species; (2) the fact that the crosses were made at the end of the vegetative period, when the temperature was lower; (3) the use of small amounts of pollen. Other possible causes are discussed. The practical value of the *rustica* x *Tabacum* sesquidiploids cannot be determined at this stage.
Further lines of research are outlined and include the study of the possibilities of the amphi- and sesquidiploid forms in relation to disease resistance and high citric acid content. (Cf. "Plant Breeding Abstracts", Vol. VII, Abst. 263).

1272. TERNOVSKY, M. F. 633.71:575.127.2:576.356.5
Die sesquidiploiden *Nicotiana rustica* L. x *N. glauca* Gr. (**Sesquidiploid *N. rustica* L x *N. glauca* Gr.**)
Genetica 1938 : **20** : 85–96.
An account in German of the work reviewed in "Plant Breeding Abstracts", Vol. VIII, Abst. 901.

1273. Mel'nikova, N. K. 633.71:575.22
(Studies on the variability of indices in *Nicotiana rustica* L.)
Vsesojuznyi Institut Tabačnoi i Makhoročnoi Promyšlennosti Imeni A.I. Mikojana (Vitim) (All-Union Mikojan Institute of the Tobacco and Makhorka Industry) Krasnodar 1936 : **2** : Pt. 132 : 129–49.
Records of variation in a large number of varieties of *N. rustica* with reference to numerous morphological and physiological characteristics of the plant as a whole, and of the leaf, stem, flowers, seed, etc., are given with some comments on the relation between variation in plants and the year when they were raised, cultural methods and varietal and regional differences. The various characters were ultimately grouped according to the degree of variation they exhibited.
A small amount of data on variation in *N. Tabacum* was also collected from observations on 100 plants.

1274. Ghimpu, V. 633.71:575.24
Sur l'hérédité de quelques variations tératologiques de *Nicotiana Tabacum.*
(On the inheritance of some teratological variations in *N. Tabacum*).
C.R. Acad. Sci. Roumanie 1938 : **2** : 159–61.
A further study of the variations reviewed in "Plant Breeding Abstracts", Vol. IV, Abst. 456, shewed that a number of the abnormalities are inherited and a list of these is given. As they are inherited without intermediate stages they are considered to be mutations and their possible mode of origin is discussed. The chromosome number was normal.

1275. Elmanov, S. I. 633.71:575.243
(Cytological characteristics of the tobacco X-rays mutants).
Vsesojuznyi Institut Tabačnoi i Makhoročnoi Promyšlennosti Imeni A.I. Mikojana (Vitim) (All-Union Mikojan Institute of the Tobacco and Makhorka Industry) Krasnodar 1936 : **2** : Pt. 132 : 196–213.
This paper presents the cytological findings from a study of root tips from the material of *N. Tabacum* Dubec Nikitskii 44 used in the work reviewed in Abst. 1276 below, and exhibiting mutations affecting the leaf blade, habit and vigour.
The direct effect of X-rays was studied at three stages in their development of the pollen mother cells and it was found that the visible effects on the pollen mother cells consisted in (1) meiotic disturbances such as failure to conjugate or to separate, fragmentation and lagging of chromosomes at anaphase and telophase, etc.; (2) irregular abnormal tetrads resulting in abnormal spores with quantitative and qualitative changes in the hereditary substance. As regards the three stages studied the pollen mother cells were most resistant, to the effect of irradiation at the resting stage, much less resistant at synapsis to diakinesis and again acquired resistance at the beginning of the first metaphase. The absence of correlation between the stage of the pollen mother cells and the intensity of mutation was confirmed.
The chromosome numbers and types of the X_1 mutants are tabulated and their fertility indicated.
No morphological types could be identified as corresponding to a particular genotype.
The genotypic changes comprised eliminations in conjunction with fragmentation, translocations, inversions, etc.
The tendency to the elimination of abnormal gametes in X_2 and X_3 is dealt with in some detail.
The haploid X-ray mutants (obtained in X_1, X_2 and X_3) did not differ essentially from haploids obtained by interspecidic hybridization.

1276. Ternovski, M. F. and
Missura, M. T. 633.71:575.243
(X-ray mutants in the tobacco plants).
Vsesojuznyi Institut Tabačnoi i Makhoročnoi Promyšlennosti Imeni A.I. Mikojana (Vitim) (All-Union Mikojan Institute of the Tobacco and Makhorka Industry) Krasnodar 1936 : **2** : Pt. 132 : 150–95.
From 1930-34 experiments were made in which flower buds and seeds of five highly inbred and pure varieties of *Nicotiana Tabacum* were subjected to X-ray irradiation of varying duration

(1–30 minutes). The dimensions of the bud were taken as an indication of the particular stages of development of the ♂ and ♀ gametophytes.
No plasmatic or vegetative mutations or "Dauer modifikationen" were found.
Younger flower buds (up to microsporogenesis) and at the reduction division in pollen mother cells were much more sensitive to irradiation.
There was no definite correlation between the size of the bud when irradiated, the number of seeds produced and the duration of irradiation, but the percentage germination varied inversely with the length of the irradiation period.
Seeds from irradiated buds shewed lowered germination capacity and the seedlings or older plants often died (especially where 30-minute doses had been given). Numerous peculiarities in the flowers, leaves, growth, branching, time of maturity, etc., of the young plants were noted as indications of mutation. Most of the mutations were due to chromosome aberrations among which heteroploidy (by elimination) and fragmentations were the most frequent; haploidy also occurred, but not polyploidy. The percentage mutation rate in 25,979 irradiated plants must have been considerably more than 7·6 while the number of mutants from different buds ranged from 1·1 per cent (4 minutes irradiation) to 60 per cent (10-minutes irradiation).
Among about 37,500 control plants one single mutant was found. From data on buds at their final stage of development it was concluded that the number of mutations obtained is proportional to the dosage—though no exact correlation can be established.
In 7,305 X_1 plants the rate of mutation in the parental irradiated male sex cells was 7 per cent as compared with the 3·6 per cent in the female cells—a difference which was also borne out by the data giving the numbers of mutating characters, which were 151 and 771 following irradiation of the female and male sex cells respectively.
There were however no differences in the kind of mutations resulting from irradiation of the two types of sex cells and in both the number of mutants increased with the duration of the treatment.
Experiments with Russian varieties and *N. Tabacum* var. *chinensis* and var. *macrophylla* shewed that the interaction of the genes in different genotypes determines the particular direction and intensity of mutation and that the capacity for exhibiting heritable variations resulting from X-ray irradiation is a specific reaction of the genotype. A small-scale experiment with a low dosage irradiation of somatic cells in seeds of three varieties resulted in plants with variations in flower colour and sterility to a greater or lesser extent. The X_1 plants however contained no mutants.
An extensive study was made of the X_2, X_3 and X_4 generations.
The percentage germination capacity of seed set by X_1 plants (first generation mutants) ranged from 80 to 0 and the resulting plants shewed very low viability. Segregation in the X_2 shewed these X_1 mutants to be all heterozygous. In general it seemed that the X_2 and X_3 tended to revert in leaf and flower characteristics to the parent form, owing (it is suggested) to the inviability of the various monosomic types underlying the X_2 and X_3 aberrations—though on the other hand some monosomics gave segregating progeny, but not in the usual Mendelian ratios. The X_2 and X_3 also shewed transgressive types. No after-effect of irradiation was observed.
In the third and fourth generations forms transmitting broad leaves were discovered but no mutants with a large number of leaves. No study of quality could be made.
In the third and fourth generations check tests were made of the constant transgressive forms, which proved normal in their chromosome number ($2n = 48$) and reduction division.
Five haploid plants that arose are described.
The various types of mutations affecting different functions and parts of the plant including habit, fertility, vegetative period and numerous characteristics of the leaf and flower are described in detail. One instance of a dihybrid segregation in the X_2 for broad leaf is cited.
The fertility of the X_1, which was markedly reduced (even to complete sterility), is discussed in detail, with comments on its pathological causes. Pollen sterility would appear to have been more frequent than disturbances in the female reproductive function. Subsequent generations were also similarly affected.
The vegetative period too shewed a wide range of variation in the mutants, some of the aberrant forms being particularly early. Others however did not flower at all in their first year. Some constant early mutations were obtained.

In general it is concluded that (1) mutants obtained by X-rays cannot be of practical use except for plants that are reproduced vegetatively; (2) gene mutations are relatively infrequent; and (3) the choice of the genotype is of great importance in determining the direct of mutation. Mutation induced by X-rays cannot at present replace synthetic breeding and further research on such X-ray problems is required.
An extensive bibliography is appended.

1277. Bugaenko, N. I. 633.71:581.162
(**Studies on the biology of tobacco flowering**).
Vsesojuznyi Institut Tabačnoi i Makhoročnoi Promyšlennosti Imeni A.I. Mikojana (Vitim) (All-Union Mikojan Institute of the Tobacco and Makhorka Industry) Krasnodar **1936** : **2** : Pt. 132 : 18–36.
The morphology of the inflorescence of the tobacco plant is described with observations upon the sequence of flowering, in 5 day periods, on branches of various level and in different varieties and upon the duration of the period of flowering, also in different varieties.
Various aspects of pollination are discussed including the receptivity of the stigma at various stages; and experimental data are given on germination, the effects on it of temperature and varying periods of storage under different conditions, and on pollen viability in relation to the stage of development of the flower.
Data collected on pollination shewed that cross-pollination does occur in tobacco, the amount of the set varying widely under different environmental conditions.
Methods of pollination are considered and the technique of mass pollination is briefly discussed from the standpoint of the resulting set and the time required for the process; the author recommends as the best method, pollination of the flower with a brush after the corolla has been cut and the pistil exposed.

1278. Bučinskii, A. T. 633.71:581.45:575.11.061.6
(**Some singularities in *Nicotiana Tabacum* yellow-leaved races**).
Vsesojuznyi Institut Tabačnoi i Makhoročnoi Promyšlennosti Imeni A.I. Mikojana (Vitim) (All-Union Mikojan Institute of the Tobacco and Makhorka Industry) Krasnodar **1936** : **2** : Pt. 132 : 37–56.
In view of the economic importance of leaf colour in tobacco a study was made of racial differences in variation of leaf colour, special attention being given to the occurrence and characteristics of yellow leaved races, both local and foreign. Little is known of their origin, but instances are cited of yellow forms which have arisen from time to time and which may possibly be due to mutations occurring in stored seed, while some of the yellow types in the Ukraine may, it is suggested, be either segregates from crosses or possibly mutations. Almost all the yellow leaved forms have sessile leaves—a fact which may be explained by the relatively greater hardiness and better development of the yellow hybrid plants with sessile leaves compared with those with petiolate leaves, as observed in certain crosses.
Yellow leaved types probably occur among all the various commercial types of *Nicotiana Tabacum* and *N. rustica* and can be grouped according to their morphological and biological features into (1) the Eastern Cigarette group; (2) the American (Burley) group and (3) the Argentine group. The economic characteristics of each of these classes are considered. None of the three are particularly vigorous as regards growth, they are susceptible to disease and to root pests and are also not resistant to drought. All the yellow leaved forms have proved susceptible to burning (i.e. drying up of the leaves after the leaves have attained the technical maturity) and the lighter the colour of the leaf the more rapidly burning occurs. Smoking tests (with or without chemical analyses) shewed that the yellow leaved forms including hybrid types from various crosses were unsatisfactory in flavour and useless for breeding purposes. Determinations of carbohydrate content were made with yellow leaved Argentine forms, two green leaved Eastern cigarette tobaccos and one manufacturers' variety Brazil and the F_1 progeny from three groups of crosses made with this material. Dominance of low carbohydrate content in F_1 is recorded.
In view of the economic importance of yellow leaf colour it will be necessary to determine whether this quality can be combined with good flavour.

Earlier results of other workers on the inheritance of yellow and green leaf colour are cited and an account is given of a large number of crosses made by the writer with yellow leaved and green leaved forms. Direct and reciprocal crosses of yellow leaved Eastern forms and Burleys with green leaved forms (of either the cigarette or cigar type) revealed complete dominance of green over yellow in the F_1. In the F_2 two types of plants were noted, green and yellow-green, the latter group forming always considerably less than a quarter of the total number of plants. The small number of yellow leaved forms is attributed not only to the mode of inheritance but also to the fact that many yellow segregates died. Different results were obtained in crosses between yellow leaved Argentine and green leaved Eastern tobaccos. The dark green Argentine variety 1266 on being crossed with the green leaved Samsun 57, a Russian strain, gave an F_1 in which up to the time of technical maturity of the leaf the dark green colour was dominant but once maturity of the leaves was attained the colour changed to yellow green which became dominant to green. In F_2 and F_3 a transgressive range of from dark green to yellow-yellow-green suggested that leaf colour was polymerically conditioned—an assumption supported by reciprocal crosses.

It should therefore be possible to obtain from the Argentine 1266 x Samsun 57 cross any intermediate colour of leaf between the colours of the two parents. Unfortunately, however, various crosses shewed that the presence of even the less pronounced yellow colour appears to reduce the carbohydrate content of the leaf and the quality of the tobacco, a correlation which is probably due to a reduction in assimilatory capacity in consequence of the low chlorophyll content which accompanies yellow leaf colour.

From a large body of experimental data on hybridization it is concluded that the yellow forms are unsuitable not only for the southern tobacco-growing regions of the U.S.S.R. but also as breeding material for the production of a high quality product. The Russian variety American 372 is recommended for use in hybridization to obtain varieties with light coloured leaves.

Future research should be directed to a study of the nature of leaf colour and its estimation and also its inheritance.

The characteristics of a number of cigarette varieties including the Russian variety Dubec 44 which has a good aroma are enumerated.

The economically valuable forms will, it is believed, be found among the types belonging to the intermediate shades among the existing range of leaf colour; and from the standpoint of the raw product light green plants are recommended as preferable for hybridization work to yellow-green forms.

1279. Kostoff, D. and Arutiunova, N. 633.71:581.8:575-181
633.71:575.125

(The cell volume of the F_1 hybrids and of their parents in relation to the size of the plants).

Vsesojuznyi Institut Tabačnoi i Makhoročnoi Promyšlennosti Imeni A.I. Mikojana (Vitim) (All-Union Mikojan Institute of the Tobacco and Makhorka Industry) Krasnodar 1936 : **2** : Pt. 132 : 109–17.

Previous relevant literature bearing on heterosis, cell size and plant size is briefly treated.

Measurements of cell size in root tips, and leaves of material obtained from a series of interspecific hybrids of *Nicotiana* species and from a *Solanum lycopersicum* x *S. racemigerum* cross shewed that some of the hybrids had cells larger than those of either parent, others smaller, while in a third group the cells were larger than those of one parent and smaller than those of the other parent. Since in the majority of the hybrids exhibiting heterosis the cells were no larger than in the parent species, hybrid vigour is due not to an increase in the size of the cells but to an increase in their number. Plants of a size intermediate between the two parents were characterized by cells smaller than those of one parent and larger than those of the other. Dwarf hybrids also occurred and of these there were two groups: (1) plants with cells smaller than those of the parents, in which case dwarfness must be attributed mainly to cell size—though there were dwarfs too in which also the number of cells was less than in either parent, (2) plants in which the cells were larger than in either parent. In this case dwarfness is due solely to the small number of cells present.

The resemblance between the dimensions of stomatal cells of *N. triplex* and *N. Tabacum* supports Kostoff's view that *N. Tabacum* originated from *N. sylvestris* x *N. Rusbyi*.
The stomatal cells shewed less variation than the cells of other types of tissue investigated.

1280. Kosmodemianski, V. N. and
Levykh, P. M. 633.71-2.42-1.521.6:576.16
Studies on the resistance of some cultivated as well as wild tobacco varieties to the root rot disease caused by *Thielaviopsis basicola*).
Vsesojuznyi Institut Tabačnoi i Makhoročnoi Promyšlennosti Imeni A.I. Mikojana (Vitim) (All-Union Mikojan Institute of the Tobacco and Makhorka Industry) Krasnodar **1936** : **2** : Pt. 132 : 5–17.

The necessity for developing root rot resistant tobaccos in the U.S.S.R. is clear and work in this direction has been proceeding in various countries, including the U.S.S.R. This paper deals with the determination of the comparative resistance of many Russian and other varieties to *T. basicola*.
Among the forms that are most resistant are those from the southern regions of the U.S.S.R. (including the Crimea), from Rumania, Bulgaria, etc., and some of the Trebizond selections would appear to be promising material for breeding resistant types.
In experiments with wild species *Nicotiana sanderae* and *N. noctiflora* remained free from the disease and other wild species shewed relatively low susceptibility.
The methods used in determining resistance are described in detail.

1281. Clayton, E. E.,
Smith, H. H. and 633.71–2.8–1.521.6:575.11
Foster, H. H. 633.71(86)
Mosaic resistance in *Nicotiana tabacum* L.
Phytopathology **1938** : **28** : 286–88.

In this fuller note (Cf. "Plant Breeding Abstracts", Vol. VIII, Abst. 913) the occurrence of duplicate, recessive factors for resistance is confirmed (Cf. also "Plant Breeding Abstracts", Vol. VIII, Abst. 914). Three classes of resistant plants can be distinguished by their leaf symptoms. The resistant varieties collected in Colombia differ in this respect and resistant segregates from crosses of Ambalema with susceptible varieties may segregate for class of resistance while breeding true for resistance. After repeated back-crosses to susceptible parents there is an apparent excess of susceptible plants in segregating generations; this is attributed to the accumulation of modifying factors, the existence of which can be inferred from the observations mentioned above, their effect in this case being to reduce the resistance to the most susceptible of the three classes.
F_1 hybrids of Ambalema with resistant varieties from Colombia falling in the two more resistant classes were all resistant; resistance is therefore determined by the same two major recessive factors in each case, the differences being due to modifiers. It is pointed out that these modifiers may cause difficulties in a breeding programme involving frequent back-crosses to the susceptible parent.
It is suggested that the mosaic resistant varieties may be an inheritance from the early and highly developed Indian agriculture of Colombia.

1282. Wellensiek, S. J. 633.72:581.44:575.22.061.1
Een merkwaardige groei-afwijking bij thee. (**A remarkable growth variation in tea**).
Bergcultures **1938** : **12** : 401–02.

Easily distinguishable characteristics are of value in the identification of clones. The peculiarity here described, which occurred in two different localities, consists in an undulating ("snake-like") type of stem and is visible even at the stage of the first leaf. The base of the leaf bends at a slight angle away from the leaf bud and as this phenomenon occurs in each succeeding leaf along the stem the latter repeatedly changes its direction, thus assuming its undulating habit. The characteristic has persisted in buddings from mother plants from the two localities where it occurred and is therefore described as a heritable variation resembling a mutation in origin. It is of no practical importance except in so far as it will readily identify any clone in which it may arise.

1283. Ferwerda, F. P. 633.73:575.12:581.142
Kiemkracht en levensduur van koffiestuifmeel. (**Germinating power and longevity of coffee pollen**).
Arch. Koffiecult. Ned.-Ind. 1937 : **11** : 135–50.
Pollen of Robusta, Excelsa and of various well known interspecific hybrids, was subjected to germination tests in hanging drop cultures in solutions of saccharose in distilled water. Robusta and Excelsa and the Conuga hybrids shewed good germination of fresh pollen (70–85 per cent). The Kawisari hybrids (from crosses of *C. liberica* and *C. arabica*) and hybrids of *C. arabica* and *C. robusta* gave a relatively high proportion of wrinkled and non-viable grains, which may, it is believed, be attributed to cytological discrepancies between the various parent species resulting in chromosome aberrations in the hybrids.
Air-dry pollen kept without any special precautions practically lost its germination capacity in a week, but if kept over calcium oxide in a desiccator retained its germination and fertilizing capacity for a month or more.
The bad effects upon coffee pollen of dew or mist and the relative resistance of the stigmas of coffee plants to damage by rain are discussed.

1284. Houk, W. G. 633.73:581.48
Endosperm and perisperm of coffee with notes on the morphology of the ovule and seed development.
Amer. J. Bot. 1938 : **25** : 56–61.
The ovule in *Coffea* is accompanied by a well developed obturator and there is apparently no distinction between the tissues of the nucellus and the integument. Only a few endosperm cells are produced and these are soon crushed by the developing embryo. The mass of tissue around the embryo is perisperm and this belongs to the parental generation.

1285. 633.73–2.19–1.521.6:575.11
Stoffels, E. 633.73:575.42
Résultats d'observations sur les populations et lignées d'Arabicas au Kivu. (**Results of observations on the populations and lines of Arabica at Kivu**).
Journées Agron. Colon. Gembloux 1937 : 129–33.
A continuation of the work already reviewed (Cf. "Plant Breeding Abstracts", Vol. VII, Abst. 733 and Vol. VIII, Abst. 605) on the behaviour of trees of Arabica coffee with brown leaf-tips and those with green leaf-tips especially with regard to their resistance to Black Tip and Dieback. The trees with brown tips (BB) are less liable to over-production and to Dieback than those with green tips (BV).
Studies on the inheritance of these characters shewed that (BB) is probably inherited as a simple mendelian dominant if the female parent is (BB) and the reverse if it is (BV), but the numbers were too small for a closer analysis.
It was observed that the progeny of the so-called local varieties were some (BB) and some (BV) while those of the introduced coffees were all (BB).
The (BB) types are also much more resistant to Black Tip than the (BV).
Arabica is very homozygous and self-pollination appears to be the rule.

1286. Bondar, G. 633.74:575.242.061.634
Une nouvelle variété de Cacaoyer : l'Almeida. (**A new variety of cacao : the Almeida**).
Rev. Bot. Appl. 1938 : **18** : 37–39.
A tree of forastero cocoa, *Theobroma leiocarpum* var. Pará, with white cotyledons has been found on an estate in Bahia. As the tree existed before the introduction of criollo cocoa in that district, hybridization is out of the question.
Except that the flowers and cotyledons are white with no trace of the usual purple colour, the mutant in other respects does not differ from the normal variety. The character is inherited and the variety is being multiplied to test the economic properties of the product.

1287. Liegeois, P. 633.74:575.42(49.3)
Sélection du cacaoyer à Lukolela. (**Selection of cacao trees at Lukolela**).
Journées Agron. Colon. Gembloux 1937 : 115–21.
The type of cacao grown is a Forastero-Amelodano fruit introduced between 1895–1900. It is well adapted to the climate and the objects of selection are increased yield and resistance to disease.
Experiments with Cundeamur cacao are not yet completed and the older variety is still recommended for planting.

1288. Yasui, K. 633.75:575.127.2:576.312.35:576.354.4
(**A cytological study on the interspecific hybrid *Papaver somniferum* x *P. bracteata***).
Jap. J. Genet. 1937 : **13** : 250–51.
On crossing *P. somniferum* and *P. bracteata* the F_1 were poorly developed and this may be due to infrequency of cell division.
As compared with the parent forms flowering was delayed in the F_1; it began in June, full bloom occurring late in July and some buds were still observed in early August. The hybrids resembled *P. somniferum* in the type of pubescence and in the shape of flower and of capsule, but they were more like *P. bracteata* in the colour of their flowers.
The chromosome number in the F_1 was 18, the sum of the parental complements, and in the pollen mother cells 4 pairs of bivalents and 10 univalents were noted at division.

OIL PLANTS 633.85

1289. Dillman, A. C. 633.854.54:581.162.32
Natural crossing in flax.
J. Amer. Soc. Agron. 1938 : **30** : 279–86.
The structure of the flower is discussed in relation to the possibility of cross-pollination. In most varieties the anthers surround and over-top the stigma and their liberal supply of pollen ensures self-pollination. When the tip of the stigma is exserted above the anthers, as sometimes happens, or the anthers are deficient in pollen, as occurred in 20 out of 600 plants raised from an F_2 selection of the cross Bison x (Argentine x Winona) then there is more chance of cross-pollination.
Observations on anthesis shewed that the anthers dehisce between 5 a.m. and 7 a.m. approximately. Experiments in which the styles were cut off at different intervals after pollination indicated that the pollen tubes reach the ovary within a few hours.
Experiments on natural cross-pollination were carried out with the following varieties:— Blanc (large, white, saucer-shaped flowers), Type 68 (an Indian variety with tubular, blue flowers), Pale Malabrigo (large, pale blue, saucer-shaped flowers), "Crimped White" (the name describes the flower), Tall Pink (flower ordinary funnel-shape, pink; Ottawa 770B (flower similar to "Crimped White" but slightly larger) and Bison (deep blue flower of ordinary funnel shape). The varieties were grown in single rows alternating with single rows of Bison. Their progeny was examined for hybrids and all supposed hybrids were tested for segregation. The experiment was performed three times, in 1931, 1932 and 1933 and at two places, St. Paul, Minnesota and Mandan, North Dakota. The average percentages of hybrids in the progenies were: Blanc, 1·88, Type 68, 0·31, Pale Malabrigo 1·53, "Crimped White" 0·62, Tall Pink 0·49, Ottawa 770B, 1·09, and Bison 0·00.

1290. Scheibe, A. 633.854.78–1.561:578.08
Ein Sonnenblumen-Rebbler für Züchtungszwecke. (**A sunflower head scraper for breeding purposes**).
Züchter 1938 : **10** : 100–01.
An apparatus is described and illustrated for the rapid removal of the seeds from sunflower heads.

1291. Plaček, E. M. 633.854.78–2.5–1.521.6
(***Orobanche* on sunflower and measures for its control**).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1937 : No. 7 : 33–36.
The authoress insists that the fact that some of the earlier produced varieties now suffer from a certain amount of *Orobanche* attack does not necessarily mean that they are completely susceptible to race B: they are cross-pollinators and may need purifying. Even if they are susceptible to the virulent race (or races), attempts should be made to improve them in this respect rather than discarding them entirely.

1292. Chevalier, A. 633.855.34:575.42
Note sur la sélection du palmier à huile. (**Note on the selection of the oil palm**).
Bull. Inst. Colon. Marseille Mat. Grasses 1937 : No. 12 : 281–92.
The author reviews the situation and suggests further means of improvement. A survey of all the plantations of the oil palm by a botanist is desirable to discover the best types, the varieties and their degree of stability. Doubt as to the value of the present selections is expressed. The careful cultivation of the best types, with elimination of the inferior trees will probably account for the increased yields.
Selection—a long process—may be undertaken, but without the expectation, in view of the heterogeneous nature of the oil palm, of very marked results.

1293. Govaert, R. 633.855.34:575.42
Bijdrage tot de studie van de veredeling van de Afrikaanschen oliepalm (*Elaeis guineensis*, Jacq.). Massale of individueele teeltkeus? [**Contribution to the study of the improvement of the African oil palm (*E. guineensis* Jacq.) Mass selection or individual selection?**].
Journées Agron. Colon. Gembloux 1937 : 122–28.
Individual selection is preferred as it gives a more definite value for the selected trees.

1294. 633.855.34:575.42(67.5)
633.912:575.42(67.5)
Leplae, E. 633.73:575.42(67.5)
Les débuts de la sélection du palmier *Elaeis*, de l'hévéa et du café, par la régie des plantations de l'état et par l'Inéac au Congo Belge. (**The beginnings of the selection of the palm *Elaeis*, of rubber and coffee by the administration of the state plantations and by the Inéac in the Belgian Congo**).
Agric. Élev. Congo Belge 1937 : **11** : 70, 131–34, 148–50, 182–84 ; 1938 : **12** : 4–6.
The aims, methods and organization of the experiment stations of the Belgian Congo for the improvement of the oil palm, rubber (*Hevea*), cacao, and coffee are briefly outlined and an account is given of the work of selection in these crops which began in 1927.

RUBBER PLANTS 633.91

1295. Cayla, V. 633.912:575
Le perfectionnement de l'*Hevea brasiliensis*. (**The improvement of *H. brasiliensis***).
Office Technique des Planteurs d'Indochine, Paris 1937 : Notice No. 10 : Pp. 52.
The principles and practice for the improvement of *Hevea* here reviewed are those that have already been tested and found satisfactory. The author does not enter into a discussion of the more doubtful points of procedure.
The methods employed for the determination of the high-yielding mother trees are first described, followed by an account of the two methods of propagation, vegetative and sexual, by grafting or from seed and finally a comparison of the two methods. Though greater

improvements may be possible by the sexual method, the results obtained by grafting are now so uniformly and rapidly achieved that for economic purposes grafting is almost always employed.
A combination of the two represents the ideal.

1296. 633.912:575.42:581.162.3(92.2)
KALIS, K. P. 633.72–1.531.12(92.2)
Beknopt overzicht van de rubber- en thee-cultuur in het Rayon Bandjar-Tasikmala-Garoet. (**Short report on rubber and tea cultivation in the Bandjar-Tasikmala-Garoet Area**).
Bergcultures 1938 : **12** : 375–80.

Observations on four rubber clones from the Pataroeman estate (60 bouw in area), which in 1917 had been planted with mother tree seed from Kiara-Pajoeng shewed good yields in 1937. It would appear that selection (in trials without repetitions) of four clones derived from a seedling plantation with an area of only 60 bouw has yielded better results than mother tree selection on a much wider and more exacting scale.
The problem of seed production received attention but in many cases disease led to a very poor set. One estate attempted artificial pollination, which appeared very satisfactory, but the ultimate yield of seed was only a few hundreds owing to a severe outbreak of mildew.
Satisfactory operations were carried out with tea seed production:

1297. TOLLENAAR, D. 633.912:581.162.3:578.08
Een onderzoek over de factoren, die de vruchtslaging bij de kruising Tjir I x XVI beïnvloeden. (**An investigation into the factors affecting the set of fruit in the cross Tjir I x Tjir XVI**).
Bergcultures 1937 : **11** : 1403–06.

The technique and precautions necessary in the artificial pollination of rubber and the results of the cross Tjir I x XVI are discussed. A set of 4·7 per cent was obtained from 28,410 pollinations. A factor of importance in determining the set was found to be choice of the proper type of inflorescence as it has been discovered that the first clusters that appear are of very little use for pollination, but the normal clusters which are produced after the tree has passed through its resting period when the new young leaves have appeared about the end of August, should be used for pollination.
The necessity is indicated of allowing for differences in the results obtained from pollinations performed by different coolies, for differences due to the hour of pollination and the season of the year. Time of day when pollination occurred seems to have little influence upon the set, whereas the season of the year appears to have an effect upon the results of pollination; this point, however, needs further investigation and especially from the physiological aspect.

1298. SCHMÖLE, J. F. 633.912:581.165.1
Verslag over den Polonia cloonen- en zaaiseltoetstuin, plantjaar : 1928, 1929 en 1930. (**Report on the Polonia test plantation of clones and seedlings—planted 1928, 1929 and 1930**).
Arch. Rubbercult. Ned.-Ind. 1937 : **21** : 224–34.

Particulars are given of the various clones and plant material tested at the A.V.R.O.S. Experiment Station and their origin and performance in the trials, in which the seedling clone No. 49 (obtained from A.V. 49 either by selfing or by crossing with clone No. 33) was used as the standard for comparison. The results are set out in 5 tables shewing the comparative yields, growth, type of trunk, bark renewal and resistance to wind damage and diseases.
Among the clones which were superior in yield to A.V. 49 were B.D. 5, B.D. 10, Tj 1 and Tj 16 (very resistant to wind damage), A.V. 183, 185 and B 84 (a particularly high yielder with other good points as well).
The yielding capacity and other features of seedlings Nos. 33, 36, 49, 163 and 185 have proved very good. No. 36 alone is susceptible to wind damage. In 1936 Nos. 36 and 163 ranked first with an output of 1,000 kg. per ha. at 6 years old.
It is pointed out that the data for yield may be regarded as accurate, but in order to obtain similarly accurate information about secondary characteristics such as disease and wind resistance experiments on a larger scale would be required.

1299. Dorsey, M. J. 634:001.4(73)
Naming new fruit varieties.
Trans. Ia Hort. Soc. 1936 : **71** : 142–47.
In this discussion on the significance of varietal names and of the work of the Committee on Nomenclature of the American Pomological Society the author stresses the importance of avoiding synonyms and homonyms, of identifying colour sports with the parent variety, of educating the public to recognize the qualities of varieties and, finally, of restricting new introductions to types of real merit.

1300. Alderman, W. H. 634:575(73)
Fruit breeding at State and Federal Experiment Stations.
Trans. Ia Hort. Soc. 1936 : **71** : 133–36.
In this rapid survey the author points out that apart from strawberries and *Rubus* and a small proportion of the grapes and plums, all the more important fruits cultivated in the U.S.A. are imported from the Old World. There are at present 45 state and federal experiment stations engaged in some form of fruit breeding and by the end of 1935, 20 of these had produced 451 varieties. They are beginning to exert a profound effect on American horticulture; in the upper Mississippi valley for instance the varieties produced by the experiment stations in Iowa, North and South Dakota and Minnesota are beginning to dominate the fruit industry.

1301. Colby, A. S. 634:575(73)
New small fruit varieties.
Trans. Ia Hort. Soc. 1935 : **70** : 34–40.
Brief notes are given on new varieties of grapes, black, purple and red raspberries, blackberries, gooseberries, currants and strawberries.

1302. Lantz, H. L. 634:575(73)
Fruit breeders' conference, November 13, 1936.
Trans. Ia Hort. Soc. 1936 : **71** : 158–59.
A brief report of the discussions, by the chairman of the conference.
H. L. Lantz described the fruit breeding work at the Iowa Agricultural Experiment Station, a feature of which is the study of apple progenies to determine which parents and parent combinations transmit desirable characters (Cf. "Plant Breeding Abstracts", Vol. VIII, Abst. 226).
A. N. Wilcox of the Minnesota University Fruit Breeding Farm, St. Paul described the apple breeding work there, which includes studies on colour inheritance. It has been found that one year of fruiting is sufficient to establish the necessary records for seedling trees in respect of size, colour, quality and seasonal characteristics.
S. W. Edgecombe of Iowa State College reported that the Virginia Crab and Hibernal stocks are triploids, which accounts for the poor results they give as breeding parents.
T. J. Maney reported that the Quiller variety is a useful parent in the breeding of anthracnose-resistant, black-cap raspberries. E. Angelo, of St. Paul, Minnesota said that their black-cap x raspberry hybrids could be propagated by leaf cuttings. C. M. Nagle dealt with the testing in the laboratory of resistance to anthracnose and mentioned the possibility of strain differences. In a discussion on interspecific hybridization N. E. Hansen of South Dakota stressed its value and the importance of growing large numbers of seedlings. He remarked that it was often difficult to get better varieties than those produced by the first cross. W. H. Alderman of St. Paul mentioned some unusual plum progenies whose remarkable uniformity suggests the possibility of apomixis. Some of the new plums produced at Minnesota combine characters of three species.

1303. ALDERMAN, W. H. 634:575(77.6)
Fruit breeding in Minnesota.
Trans. Ia Hort. Soc. 1936 : **71** : 136–39.
A brief history of fruit-breeding work in Minnesota.
In conclusion a brief outline of the work in producing a new variety is given. In the later stages of trials, Minnesota seedlings are tested at 48 experiment stations in the U.S.A., 7 in Canada and at 40 cooperative trial stations in Minnesota. They are also grown by members of the State Horticultural Society.

1304. HANSEN, N. E. 634:575(78.3)
New hardy fruit.
Trans. Ia Hort. Soc. 1936 : **71** : 139–42.
Of 45 apricot seedlings introduced to Brookings, South Dakota from northern Manchuria (Manchukuo) the 12 best have been given the following names Manchu, Mandarin, Chow, Sing, Ninguta, Tola, Anda, Zun, Sino, Lalin, Hulan and Sansin.
The following crabapples with red flowers and red flesh have been produced: Redflesh (*Pyrus Malus Niedzwetzkiana* x Elk River (Minnesota) crab), Zelma and Zita (*P. Malus Niedzwetzkiana* x Yellow Siberian crab) and Zaza [(Duchess x *P. Malus Niedzwetzkiana*) x Siberian crab]. Dolgo and Alexis also make red jelly, sauce and preserves though their flesh is white; externally the fruit is a brilliant, dark solid red with a trace of blue bloom.
A very hardy pear, *Pyrus ussuriensis*, introduced from near Harbin is resistant to the bacterial disease fire blight and has been named Harbin. Four pears released since 1933 are Sadko (Russian sand pear x Vermont pear), Krylov and Sladky (Saponsky pear of eastern Siberia x Lincoln pear) and Finland, an open-pollinated seedling of the Yellow Early Finland pear, the pollen parent being probably the Russian sand pear.

1305. LIJFTOGT, G. 634:581.162.32:581.6
Over de invloed van het stuifmeel op de kwaliteit van het fruit. (**On the effect of the pollen on the quality of the fruit**).
Fruitteelt 1938 : **28** : 2–11 ; 38–44.

STUIVENBERG, J. H. M. VAN
Oefent het stuifmeel invloed uit op de eigenschappen van de vrucht? (**Does the pollen exert an influence on the qualities of the fruit?**)
Fruitteelt 1938 : **28** : 44–47.
The first paper presents data which the author collected on various crosses in pears, apples and other fruits. He concludes that the particular pollinator used frequently determines the size and quality of the crop and also appears to influence the occurrence of the disease internal cork in apples.
In the second paper instances are cited which are interpreted as demonstrating the occurrence of meta-xenia in apples and pears, and the necessity for good pollinators which will produce fruits of uniform size is emphasized with observations on how the choice of such trees should be made.
The third paper contains a critical reply to these views.

1306. YEAGER, A. F. 634-2.111-1.521.6(78.4)
Hardy fruits.
Rep. Neb. Bd Agric. 1937 : 525–29.
Hardy varieties of the following fruits are mentioned: apples, crab apples, plums, sand cherry hybrids, strawberries, gooseberries, red currants, grapes, pears and raspberries. Breeding for hardiness in North Dakota with apricots and cherries is mentioned and a number of native fruits are recommended for cultivation.

1307. Fagen, F. N. 634-2.111-1.521.6:575(74.8)
Fruit breeding in Pennsylvania.
Trans. Ia Hort. Soc. 1936 : **71** : 153–58.
All fruit breeding in Pennsylvania has been conducted by private individuals. The importance of local markets, coupled with their demand for the old varieties has not encouraged the experiment station to attempt varietal improvement. Severe winters in 1933–34 and 1935–36, causing great damage to orchards, have induced an interest in the problem of hardy stocks as a method of avoiding winter injury.

1308. Schmidt, M. 634.1/2:575
Aufgaben und Stand der Züchtung von Kern- und Steinobstsorten. (**Problems and position of the breeding of pome and stone fruits**).
Forschungsdienst 1938 : **5** : 27–48.
The general principles involved in the breeding of élite varieties of fruit are considered, with a review of the work already accomplished on apples, pears, quinces, cherries, plums, apricots, peaches and almonds. The bibliography has 211 titles.

1309. Shaw, J. K. 634.11(73)
The classification and evaluation of varieties of apples in the Northeast.
N.J. Hort. Soc. News 1938 : **19** : 1001–04, 1017.
Tables are given shewing the classification of 62 older and 68 newer varieties of apples in Maine, New Hampshire, Vermont, Massachusetts, Rode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland and West Virginia into the following classes: 1, recommended for planting in commercial orchards in any given State; 2, recommended for commercial planting only in special localities, for special conditions or by certain growers in any State; 3, varieties other than those in 1 or 2 and which may be desirable for home orchards; 4, of little or no commercial value, not recommended for planting; 5, new varieties of promising commercial value; 6, new varieties of doubtful commercial value and 7, new varieties of no apparent commercial value.

1310. Howlett, F. S. 634.11:575(77.1)
The newer apple varieties.
Proc. 71st Annu. Mtg Ohio Hort. Soc. 1938 : 95–101.
Fairly new varieties which are now being planted in Ohio are, in order of maturity, Lodi, Melba, Cortland, Golden Delicious and Turkey. New varieties which shew most promise at the Ohio Experiment Station, Wooster, are Joyce, Early McIntosh, Kendall and Newtosh, again in order of maturity.
In the apple breeding programme at the Ohio Experiment Station, primarily designed to obtain a late blooming variety with the Rome Beauty season but of better quality, the following five seedlings have been named and are now being tested rather extensively: Warder (open-pollinated seedling of Rome Beauty, picking season late September), Franklin (McIntosh x Delicious, early October), Kirtland (Ingram seedling, first to second week in October), Shaw (Ralls x Mother, middle to third week in October) and Downing (Gallia Beauty x Kirtland, third week in October). Brief notes on the characteristics of these seedlings are given.

1311. Nilsson-Ehle, H. 634.11:576.356.5:575
634.972.3:576.356.5
Darstellung tetraploider Äpfel und ihre Bedeutung für die praktische Apfelzüchtung Schwedens. (**Production of tetraploid apples and their significance for practical apple-breeding in Sweden**).
Hereditas, Lund 1938 : **24** : 195–209.
An important aim in Swedish fruit-breeding is the development of long-keeping, late varieties of apples. It has been shewn that triploids keep well (Cf. "Plant Breeding Abstracts", Vol. VII, Abst. 1,354) and the problem is therefore to breed new triploid varieties, for which purpose tetraploids are required, to cross with diploids.

Large numbers (in all 80,000) of open pollinated seeds of Belle de Boskoop and Blenheim, two triploid varieties, were sown and among the more vigorous of the plants thus obtained were found four tetraploids, all from Belle de Boskoop. These had relatively broad, deeply serrated and rather large leaves and also large stipules.
The use of such forms in breeding is discussed, with special reference to fruit size, vitamin C content and frost resistance.
It is mentioned that a tetraploid aspen has also been produced, by controlled pollination of a triploid aspen by a diploid.

1312. Bergström, I. 634.11:576.356.5:581.481
Tetraploid apple seedlings obtained from the progeny of triploid varieties.
Hereditas, Lund 1938 : **24** : 210–15.
In the successful attempt to raise tetraploid apples (Cf. Abst. 1311), 4,000 open-pollinated seedlings were raised from the triploid varieties Belle de Boskoop and Blenheim. About 70 seedlings picked out at random were found to have somatic chromosome numbers ranging from 34 (diploid) to 51 (triploid), with the mode at 39. To narrow the search for tetraploids seedlings were selected for vigour and for characters which, by analogy with triploids and from the experience of E. Johannson (Cf. VIII, Abst. 945), would be expected in tetraploids. Some 70 seedlings were selected in this way and the chromosome numbers of 51 were determined; they ranged from 34 to 68, four being tetraploid.
From Blenheim 16 pairs of twin seedlings were obtained and 5 from Belle de Boskoop. None of the plants whose chromosome numbers could be determined were tetraploid, most were diploid and one had $2n = 52$.
Stoma size in diploids, triploids and tetraploids was found to increase with chromosome number.

1313. Tanaka, Y. 634.21(52)
(A monograph of *Prunus Mume* with reference to its fruiting varieties).
Contr. Hort. Inst. Taihoku Univ. 1936 : **22** : Pp. 44.
An account is given of Japanese varieties of mumé grown for fruit, including a diagnostic key. Nearly a half of the varieties studied were self-incompatible, though this is often due to paucity of functional pollen grains. Cross-incompatibility between certain varieties is suspected.
The mumé variety, Bungo, has been suspected of being actually a hybrid between the mumé and the apricot and the F_1 hybrid from an artificial cross did in fact closely resemble the Bungo variety.

1314. Yenikeyev, K. K. 634.23:575.127:576.354.4
A cyto-genetical study of the intergeneric hybrid "Cerapadus".
Genetica 1938 : **20** : 187–216.
Cerapadus is a fully fertile hybrid produced by I.V. Michurin in 1935 by crossing his sour cherry "Ideal" (*Cerasus fruticosa* Pall x *C. pennsylvanica* L.) and the Maack bird cherry (*Padus Maackii* Repr.). The Ideal sour cherry has 32 somatic chromosomes, as has the Maack bird cherry. The F_1 hybrid has the same chromosome number but lagging chromosomes at meiosis are more frequent than in the parent forms, which have regular meiosis. In the hybrid some cells with $14_{II} + 1_{III} + 1_{I}$ were observed as well as those with 16_{II}. At second metaphase plates with 16–16, 17–15 and 18–14 were observed.
The maternal parent (Ideal sour cherry) is a dwarf, the pollen parent of vigorous growth; the F_1 hybrid is vigorous. The maternal parent has a dark brown trunk and the pollen parent a yellow trunk; the F_1 has a dark brown trunk. The acidity of the bird cherry dominated over the sub-acidity of the sour cherry, but in other respects the F_1 hybrid was intermediate. Its fruits were of poor quality. In the F_2 wide segregation was observed, surpassing the parent limits in such characters as time of flowering and fruiting and productivity. There

was a rather close association between size of fruit and type of cluster. Fruits borne in racemose clusters, as in the bird cherry tended to be small, those in umbellate clusters as in the sour cherry tended to be large. It was possible, however, to select in the F_2 seedlings with large fruits in racemose clusters.

An F_2 seedling resembling the maternal parent had 32 chromosomes forming at meiosis $13_{II} - 6_I$; the shy bearing of this tree is attributed to the irregularities observed at meiosis. Another F_2 seedling resembling the paternal parent had 32 chromosomes and a normal meiosis. A low yielding seedling was found to have 34 chromosomes, forming $15_{II} + 1_{IV}$, $15_{II} + 1_I + 1_{III}$, 17_{II} or $13_{II} + 5_I + 1_{III}$; lagging chromosomes were frequent. Other aneuploids with 33 chromosomes occurred.

A Cerapadus F_1 seedling was crossed with Michurin's hybrid Northern Beauty (Krasa Severa) (*Cerasus vulgaris* Mill. x *C. avium* L.) which also has 32 somatic chromosomes. Many of the Cerapadus characters dominate in the F_1 hybrid, which has five different species in its ancestry. The 32 chromosomes of this hybrid form such configurations as $15_{II} + 2_I$, $13_{II} + 1_{IV} + 2_I$ and lagging is frequent, pollen abortion high.

In the discussion the importance of geographically distant crosses in fruit breeding is discussed.

1315. Manns, T. F. 634.25(73)

Classification and evaluation of varieties of peaches grown in the Northeastern States.

Trans. Peninsula Hort. Soc. 1937 : **27** : No. 5 : 102–06.

The peach varieties are classified in this article as were the apple varieties in the article reviewed in Abst. 1309.

1316. 634.25:575(73)
634.22(73)

Gibson, R. E. 634.23(73)

Variety trends with peaches, cherries and plums.

Proc. 71st Annu. Mtg Ohio Hort. Soc. 1938 : 121–34.

Brief accounts are given of the following peach varieties: Elberta, originated in Georgia about 1870 and has been the leading variety in the U.S.A. since 1915; J. H. Hale, a chance seedling found by Mr. Hale in Missouri and introduced in 1912; Gage Elberta, arose as a bud sport in Texaco, Illinois, discovered by J. A. Gage; Fertile Hale, is self-fertile whereas the original J. H. Hale is self-sterile, arose as a whole tree sport in an orchard in Lawrence, Michigan, introduced in 1931; South Haven, a whole tree sport found in an orchard of Yellow St. John at South Haven, Michigan, introduced in 1919; Halehaven, a hybrid between J. H. Hale and South Haven, released from the South Haven Experiment Station in 1932 and proving very popular; Vedette, Veteran and Valiant introduced by the Vineland Experiment Station; Golden Jubilee Oriole, Cumberland and Ambergem Clingstone introduced by the New Jersey Experiment Station; Salberta, a hybrid between Salway and Elberta, produced by W. C. Rofkar of Catawla Island, Ohio, in 1913, the best commercial variety of the late peaches.

The cherry varieties mentioned are Hedelfingen, an old German sweet variety and Montmorency, the standard sour variety.

The plum varieties mentioned are Stanley Prune (Agen x Grand Duke), Hall and Abion.

1317. Pitt, D. T. 634.25:575(74.9)

The 1937 survey of the New Jersey peach industry.

N.J. Hort. Soc. News 1938 : **19** : 1000, 1013.

Data are given on the numbers of trees of different varieties in New Jersey in 1937. Elberta, J. H. Hale and Golden Jubilee are the three leading varieties, in that order. Golden Jubilee was the most frequent of the varieties produced by the New Jersey Experiment Station. The figures for trees in different age classes shew that varieties developed by the Station are increasing in importance.

1318. 634.25:581.162.5
634.25:581.461
JAHN, A.
Weiterer Beitrag zur Frage der Sortenbeschreibung und der Fertilitätsverhältnisse beim Pfirsich II (Blütenbilder). [**A further contribution on the question of the description of varieties and fertility in the peach II. (Flower descriptions)**].
Gartenbauwiss. 1938 : **11** : 573–96.
In continuation of Brandscheidt's work reviewed in "Plant Breeding Abstracts", Vol. IV, Abst. 763, detailed descriptions of the flowers of important peach varieties in the Palatinate are tabulated and discussed. Care was taken as far as possible to include only genuine varieties true to type. Data on the time of flowering, leaf development and relative number of flowers are also shewn in the tables. The information collected in this study could be used in investigating the inheritance of flower shape and size.
Some pollen germination tests and crosses are also cited as shewing the variation that may occur in the progeny of seedlings of reputedly true breeding varieties.

CITRUS FRUITS 634.3

1319. 634.3(54)
634.3(52+51)
TANAKA, T.
(On certain subtropical Citrus fruits).
Studia Citrol. 1937 : **8** : 68–84.
Descriptions are given, including Latin diagnoses, of the Indian forms Mosambi (*Citrus sinensis* Osbeck var. *rugoso-dulcis* var. nov.) and Chota Kitchlee (*C. Reshni* Hort. var. *canaliculata* var. nov.) and of the Yuhikitsu (Taohung Kieh) of Formosa and south China (*C. oleocarpa* Hort. ex Tanaka sp. nov.).

1320. NAKAMURA, M. 634.3:575.127.2:581.145.1
A note on the premature flowering in a Citrus hybrid.
Studia Citrol. 1937 : **8** : 29–32.
An F_1 seedling from the cross Yamamikan (*C. intermedia*) x Ponkan (*C. chrysocarpa*) produced a flower at the age of seven months. Though the anthers contained about 70 per cent good pollen the ovary was deformed and no fruit was set after artificial selfing.

1321. TANAKA, T. 634.3:581.9(54)
On Indian Citrus fruits.
Nettai Engei (Hort. Trop.) 1937 : **7** : Pp. 12.
Northern India is the centre of origin of *Citrus* and the variety of forms existing there is of great value to breeders. The sweet orange, sour orange, lime, citron, lemon and shaddock all came from there or Burma, as is easily shewn from botanical collections as well as by the fact that their Sanskrit names antedate the corresponding Chinese names.
The author has identified certain Indian citrus forms as follows: Suntara = Ponkan (*C. chrysocarpa* Lush.); Keonla = a *Microacrumen* (*C. crenatifolia* Lush); Khatta = a *Citrophorum* (*C. Karna* Raf.) and Jambhiri = Florida Rough (*C. Jambhiri* Lush).

1322. UPHOF, J. C. T. 634.3–2.111–1.521.6:575.127.2
Wissenschaftliche Beobachtungen und Versuche an Agrumen. IX. Der Einfluss von Frost. (**Scientific observations and experiments on citrus fruits. IX. The effect of frost**).
Gartenbauwiss. 1938 : **11** : 391–412.
Data have been collected on the relative resistance or susceptibility of different *Citrus* species and hybrids (represented by experimental and commercial material) to severe frosts in Florida, U.S.A. Physiological factors in cold resistance such as nutrition and manuring and the influence of the stock are discussed. The performance of varieties and interspecific hybrids of a number of species is recorded. Some evidence of inherited cold resistance was obtained

from data on certain varieties of Tangelo (*C. nobilis* Lour, var. *deliciosa* Swingle x *C. paradisi* Macf.). The tangerine parents (*C. nobilis* Lour var. *deliciosa* Swingle) all suffered severely from frost, the grapefruit parents less; and the hybrids with the exception of Mineola, the trees of which were very young, appeared to have inherited much of the resistance capacity of the grapefruit. Two Siamelo seedlings from the cross King Mandarin, *C. nobilis* Lour x *C. paradisi* Macf. shewed intermediate inheritance. King Mandarin was highly susceptible. A similar case of intermediate behaviour was found in the hybrid between lemon and grapefruit, *C. Limonia* Osbeck x *C. paradisi* Macf.

The Limelo, a cross between lime, *C. aurantifolia* x grapefruit, *C. paradisi* Macf. suffered severely from frost, but recovered sufficiently after heavy pruning close to the soil to develop into a weak tree.

The Citrange, a *C. sinensis* Osbeck x *C.* (*Poncirus*) *trifoliata* Raf. cross has yielded many resistant forms e.g. Colman, Morton, Rusk and Savage. *C.* (*Poncirus*) *trifoliata* Raf. is highly resistant to cold.

A Cibradia, which is a hybrid of *C.* (*Poncirus*) *trifoliata* Raf. x sour orange, *C. aurantium* L. suffered considerable leaf damage under frost but its branches were uninjured and the tree made a good recovery and set flowers abundantly. The pollen parent of this cross withstands —6° C. of frost moderately well.

Two other hybrids which shewed intermediate frost resistance were the Mandelo (Mandarin, *C. nobilis* Lour var. *deliciosa* Swingle x grapefruit *C. paradisi* Macf.) and the Clemelo (*C. nobilis* Lour. var. *deliciosa* Swingle x grapefruit *C. paradisi* Macf.).

The Limequat hybrid obtained from the cross lime, *C. aurantifolia* Swingle x Marumi kumquat, *Fortunella japonica* Swingle, recovered in many instances with subsequent pruning, though the female parent is excessively sensitive to cold after severe damage by frost.

The Temple-Mandarin which is probably a hybrid between a variety derived from the mandarin *C. nobilis* Lour var. ? x the orange *C. sinensis* Osbeck and is apparently specially valued for the aroma of its fruits, can withstand various degrees of frost according to the stage of dormancy of the tree and according to the variety used as a stock and the amount of protection offered by the site of cultivation (Cf. "Plant Breeding Abstracts", Vol. VII, Abst. 291).

1323. 634.322(51+91)
TANAKA, T. 634.322 *C. suhuiensis*
(The Suhuikan, a remarkable tropical loose-skin orange from Canton and Singapore).
Nettai Engei (Hort. Trop.) 1937 : **7** : 99–114.

The Suhuikan loose-skin orange of Canton Province and the Singapore mandarin (Limau Hijan Manis) are found to belong to the same species *Citrus suhuiensis* Hort. ex Tanaka.

1324. CALIDIORE, E. 634.322:575
Il mandarino "Clementina". **(The tangerine "Clementine").**
L'ortofruttic. Italiana 1938 : **7** : 28–31.

A description of this variety of tangerine obtained from a cross between the common tangerine and the Chinese bitter orange (Cf. "Plant Breeding Abstracts", Vol. VI, Abst. 1381, and Vol. VII, Abst. 770).

NUTS 634.5

1325. CRANE, H. L.,
REED, C. A. and
WOOD, M. N. 634.5:575(73)
Late developments in nut breeding.
Bett. Fruit 1937 : **31** (11) : 8–9.

Brief review of breeding work in the U.S.A. with chestnuts, for resistance to blight; filberts, for resistance to disease and cold; pecans, for general improvement; hickory nuts; walnuts; almonds and pistachio nuts.

1326. TAMMES, P. M. L. 634.61:581.162.3:578.08
Over den bloei en de bestuiving van den klapper. (**On the floral biology of the coconut**).
Landbouw 1937 : **13** : 74–89.

This paper deals with the structure and development of the male and female inflorescence of *Cocos nucifera* L., the numbers of flowers of each sex and the collection of pollen for artificial pollination. Under suitable conditions pollen can be kept for 21 days and still retain its viability.

The ordinary form of coconut is mainly cross-pollinated; but in the dwarf form the periods during which the male and female flowers are open coincide long enough to allow of self-pollination by insects or by the wind. Artificial selfing and crossing are both stated to give good sets. The technique is described.

Work by other investigators is reviewed.

1327. CHEVALIER, A. 634.651:577.81:575
Le *Carica monoïca* Desf. Variation monoïque héréditaire du Papayer commun. (***C. monoïca* Desf. A hereditary monoecious variation of the common papaya**).
Rev. Bot. Appl. 1937 : **17** : 903–05.

Three types of monoecious plants are distinguished; (1), in which the inflorescences are all short and female, but some staminate flowers occur among them; (2), the plant bears long bunches of male flowers among which are a few female ones and (3), in which both the long bunches of male flowers and the short bunches of female flowers are borne on the same plant. These monoecious types have been observed to occur as mutations in various parts of the world where the papaya is cultivated and for the most part they are stable forms that can be reproduced by seed.

1328. 634.653
Report of the Variety Committee of the California Avocado Association, 1937.
Yearb. Calif. Avocado Ass. 1937 : 40–46.

Brief accounts are given of eight varieties in commercial production, three Mexican varieties and eight experimental varieties.

1329. POMEROY, C. S. (Editor) 634.653
Avocado variety check list.
Yearb. Calif. Avocado Ass. 1937 : 13–34.

Over 450 avocado varieties are listed, with indications of whether they are Mexican, Guatemalan or West Indian types. The place of origin and a brief description are also given.

1330. HODGSON, P. W. 634.653:575(79.4)
The University's research program on the avocado.
Yearb. Calif. Avocado Ass. 1937 : 228–33.

One of the methods being used in an effort to solve the problem of irregular bearing in the Fuerte variety is the selection of strains within the variety. Another method contemplated is the breeding of new varieties by hybridization to combine the fruit characteristics of Fuerte with the bearing behaviour of varieties like Anaheim or Dickinson.

1331. 634.653:581.162(92.2)
BIJHOUWER, A. P. C. 634.653–1.524.4(92.2)
Bloeiwaarnemingen bij advocaat (*Persea gratissima* Gaertn.) [**Observations on flowering in the avocado (*P. gratissima* Gaertn.)**].
Landbouw 1938 : **14** : 118–28.

After a general description of the phenomena of flowering in the avocado the behaviour of some Javanese and some imported varieties in the Ragoenan experiment plantation at Pasar Minggoe (Java) is recorded. Among the Javanese varieties, Idjoe pandjang, in which the stigmas remain receptive so long that pollination can occur during the male stage, was the only heavy bearer. A few varieties differed in their behaviour in the tests at Ragoenan as compared with observations taken in other countries.

Further investigations on pollination have been planned for 1938.

SMALL BUSH FRUITS 634.7

1332. Schwartze, C. D. 634.711:575(75.3)
Breeding red raspberries in the state of Washington.
Bett. Fruit 1935 : **29**(10) : 6–7.

A brief and popular account of the methods and results of breeding hardy varieties in Western Washington. Crosses were made between the susceptible variety Cuthbert and hardy varieties including the new variety Lloyd George. Many of the hybrids are promising.

1333. Schwartze, C. D. 634.711–2.111–1.521.6:575(75.3)
The Washington and Tahoma red raspberries.
Pop. Bull. Wash. Agric. Exp. Sta. 1938 : No. 153 : Pp. 11.

The Washington variety was bred from a cross between Cuthbert and Lloyd George, the object of the work being to produce a variety with the fruit quality of Cuthbert but with increased winter-hardiness. It was found during the course of the work that the susceptibility of Cuthbert to winter-killing was due to the short rest period of its buds.

Tahoma is a hybrid between Lloyd George and Latham and is offered as a superior type for transport in fresh condition to distant markets and is also resistant to frost injury during the winter months.

Descriptions of the two varieties are given.

1334. Clark, J. H. 634.75(74.9)
The newer varieties of strawberries and their value in the commercial field.
Trans. Peninsula Hort. Soc. 1937 : **27** : No. 5 : 82–87.

The classification of strawberry varieties in New Jersey into the seven classes enumerated in Abst. 1309 is given.

1335. Gutierrez, M. E. 634.75:575(91.4)
Progress report on strawberry tests at Baguio, Mountain Province.
Philipp. J. Agric. 1937 : **8** : 391–416.

In addition to variety tests, the work on strawberries at Banuio Plant Industry Experiment Station includes the raising and selection of seedlings for varietal improvement.

1336. Demaree, J. B. and
Darrow, G. M. 634.75:575.11.061.633
Leaf variegation in strawberries not considered a virus disease.
Plant Dis. Reporter 1937 : **21** : 400–03. (Mimeographed).

A defect of the Blakemore and certain other varieties of strawberries, which consists of a variegation of the leaves followed by yellowing and is known as June yellows, cannot be transmitted by any of the methods commonly used in virus work and does not appear to be infectious in the field. It is suggested that it is an hereditary character, appearing by somatic mutation.

Data are given shewing the proportion of seedlings turning yellow which are obtained when various strains and varieties are selfed. It appears that yellowing is not due to a single gene. Within the varieties at present affected, the trouble can be controlled by using stocks which do not produce yellowing plants. It may be possible to breed varieties without this defect when its inheritance is better understood. In the meantime the use in breeding of varieties in which the genes for yellowing are not found is indicated.

VITICULTURE 634.8

1337 *Negrul, A. M. 634.8:575.1
(The Genetic Basis of Grape Breeding).
Bull. Appl. Bot. Leningrad 1936: Ser. VIII(6): Pp. 149.

An outline of vine breeding up to the present time is given, with a table shewing all known interspecific hybrids. Results of the Ukrainian Institute of Viticulture shew that most, though not all varieties give seeds of reduced viability on inbreeding. No heterosis was

* An abridged translation of this paper is on file at the Bureau.

observed in crosses with *Vitis vinifera* but it occurred in a great number of interspecific hybrids and the F_2 of these hybrids obtained by selfing contained a large number of dwarfs and other anomalies, most of the plants being low in vigour. Some varieties on inbreeding reproduce the parental type more or less closely, others produce a number of aberrant seedlings. On self-pollinating 89 hermaphrodite varieties only nine of them gave good seeds and seedlings. Depressed plants with simplified leaves occurred regularly in a ratio of approximately 1 : 3 in the progeny of Husseine and a number of allied varieties. The author concludes that the value of inbreeding can only be judged in relation to individual varieties, every one of which behaves differently in this respect. The heterosis observed by various authors in crosses between vines from different localities is thought to exemplify the now familiar behaviour of geographically distinct varieties on hybridization. The possibility that plasmatic differences are responsible is not, however, excluded.

In European-American crosses the F_1 usually resembles the American parent, though the leaf form, expecially degree of dissection, is dominant and independent of general habit. The more dissected type was in general dominant, which applied also to crosses within *V. vinifera*, with the exception of the mutant "parsley" type, which is recessive.

Five grades of leaf pubescence are established and the various species are classed accordingly. The types are shewn to be genetically distinct; pubescence was dominant to glabrous, leaf and shoot pubescence being inherited separately. The inheritance of pubescence is of great importance in breeding for resistance to *Epitetranichus altheae*, certain types being immune owing to the difficulty of oviposition on glabrous or nearly glabrous leaves.

The data on leaf coloration inheritance agree with those of other authors. The autumn coloration is a useful character in breeding as it enables the fruit colour to be determined in the seedlings before they start to bear fruit, red colour and coloured fruits being inseparably linked in *V. vinifera* crosses. The ratios of variegated seedlings in selfs and crosses were not always in agreement with the data given by earlier authors.

The common, unusual and anomalous floral types met with in the vine are illustrated. Among the anomalous floral forms are the "true females", with no stamens at all, known only in one variety, Mourvèdre. This type has a corolla opening upwards in the form of a star and a 5–6 lock ovary, and would therefore botanically have to be ascribed to a different genus and even subfamily, were it not known almost undoubtedly to be a recessive bud mutant from the normal hermaphrodite Mourvèdre, with which it is identical in all but floral and fruit characters; hybrids between the two have been obtained and are all hermaphrodite. Data are given on the inheritance of floral type in crosses between forms of different type, together with the author's scheme for the interpretation of the results. The hermaphrodite is thought to have arisen as a mutation from the male form, the dominant genes for the suppression of the ovary and egg cell having mutated to the recessive allelomorphs. The prevalence of hermaphrodite forms among cultivated vines is apparently the result of artificial selection. In breeding, it is advisable to use hermaphrodite varieties of the formula *Fn Fn*, whereby an entirely hermaphrodite progeny is ensured.

True seedlessness (parthenocarpy) is found only in *V. vinifera* ssp. *sativa*. An examination of the existing parthenocarpic varieties (currants and sultanas or Kishmish) indicates the main region of their origin to be Iran and Turkey. Most of them would appear to have arisen by bud mutation, though several cases are now known where parthenocarpic forms have arisen in the process of hybridization. The abnormality is shewn to be in the female apparatus. Seedlessness is shewn to be a hereditary character, apparently polymeric and recessive. This accounts for the existence of only 10–15 seedless varieties among several thousand existing grape varieties. Now that their genetic constitution is understood they can be produced in any quantity by crossing partially parthenocarpic with parthenocarpic individuals. Five promising new seedless forms have already been reproduced by hybridization.

Data on the inheritance of fruit size and form, both polymeric characters, are given. The results on fruit coloration confirm Rasmusson's assumption of 2 complementary colour factors, a number of other factors influencing the exact shade.

The foxy flavour of *V. Labrusca* also appears to be polymeric. The muscat seems to have arisen as a mutation in Arabia, Egypt or some neighbouring central European country. A bud mutant with larger fruits of muscat flavour was found by Kolesnikov (unpublished) in

1935 on the variety Gros Coulard. Transgressive segregation was observed for sugar and acid content, which are evidently both polymeric characters.
F_2 seedlings were tested for root phylloxera on an artificially infected plot at Odessa and shewed clear segregation, differing in different combinations, the most promising of which was Mourvèdre x Rupestris 1202. Resistance to mildew is also polymeric.
Hybrids between hardy and susceptible species were mainly intermediate. Those of Nimrang x Saperavi (hardy European variety) on the other hand are nearly all quite hardy and the hope is entertained that by suitable choice of parental forms it will be possible to breed hardy vines without recourse to interspecific crossing.
Positive correlations observed are coloration of autumn leaves and coloured fruit, leaf dissection and yield, seedlessness and small fruits, earliness and low yield and juicy fruit and a slight negative correlation between resistance to mildew and leaf phylloxera. All other characters investigated combined freely.
Indications are given of the use this genetical information can have in the work of raising improved varieties.

1338. Pirovano, A. 634.835:575.12:575.73
Fluttuazione ed assestamento definitivo nella fruttificazione degli incroci e degli ibridi. (**Fluctuations and definite order in the fruiting of crosses and hybrids**).
L'ortofruttic. Italiana 1938 : **7** : 1–3.
It is noted in the progeny of vines of which the varieties "Terra promessa" or Agostenga were parents that in the first generation the grapes were large but in succeeding generations the size of the grapes diminished though that of the bunches increased.
A similar phenomenon was noticed in crosses between species of *V. vinifera*, the taste of the early generation was bitter and rough but this gradually changed to a light muscat flavour.

1339. Breider, H. and 634.835:577.88:575
Scheu, H. 634.835:575.127.2
Die Bestimmung und Vererbung des Geschlechts innerhalb der Gattung *Vitis*. (**The determination and inheritance of sex within the genus *Vitis***).
Gartenbauwiss. 1938 : **11** : 627–74.
The work and theories of previous investigators are analysed in some detail before the writer describes his attempt to interpret sex determination in *Vitis* on a purely genetical basis, a point of view for which support will be sought later in studies of the biology of flowering and development.
The effect of external factors on sex was confirmed in the case of male and female clones of *Riparia* and *Rupestris* and hermaphrodite hybrid clones from crosses of European x American varieties of vines. The material available for sex inheritance consisted of an extensive collection of data from selfings and crossings of European vines (1,500 *Vinifera* seedlings), 1,200 F_1 interspecific hybrids and 9,667 F_2 plants from various crosses and from selfings of varieties and hybrid F_1 progeny.
Three basic types of vine flowers and three variants of each, namely male, functionally female and hermaphrodite forms are discussed with illustrations and comments on the findings of other workers and on environmental modifications that may occur. It is remarkable that the *Vitis vinifera* varieties, Aramon and Madeleine Angevine, exhibit a greater tendency to variability in the flowers than do the almost completely dioecious American species *Riparia* and *Rupestris*. In connexion with the sterility of the pollen of functionally female flowers, experiments now in progress should decide whether the germination capacity of the pollen varies according to the morphological formation of the female flower.
A study of variation in the male flower within a stock and within a clone made with clones of *Vinifera*, *Rupestris* and *Riparia* tended to shew that the male flowers of *Vinifera* and *Riparia* react more easily and markedly to environmental influence than do the flowers of *Rupestris* which are on the whole very uniform.

On crossing the *Vinifera* variety Gamay with *Riparia* as the pollen parent the F_2 male forms produce flowers of the three variant male types which are moreover also obtained from the Aramon x *Riparia* cross. No such extensive variation in the male flowers was, however, obtained from the cross Mourvèdre (a *Vinifera* variety) x *Rupestris*, the progeny producing mainly pure male flowers with a certain number belonging to only two of the variant male types.

This capacity for response to environment (as instanced in *Vinifera* and *Riparia*) is heritable though the actual different types of flowers are not inherited. Moreover vines differ in the type of response, for example *Rupestris* reacts by forming almost uniform flowers whereas *V. riparia* and *vinifera* exhibit numerous variants.

A study of variation in hermaphrodite flowers raised the question as to whether certain male forms found among a Riesling (*V. vinifera*) progeny obtained by selfing were not due to the influence of environment and suggests that though dicliny and monocliny are hereditarily fixed conditions the degree of development of male, female and hermaphrodite flowers is to a considerable extent controlled by external factors.

While accepting the view that in American and Asiatic vines the male form is XY and the female XX as regards sex determination, the writer points to the need for further investigation of the conditions in *V. vinifera* in which the origin of the hermaphrodite forms and the deviations from the XX–XY monohybrid back-cross scheme of sex inheritance require explanation. From results obtained with numerous progenies derived by inbreeding and with "pure" *vinifera* crosses as well as interspecific crosses the author draws the following conclusions:— the assumption that hermaphrodite *Vitis* clones are secondarily bisexual is supported by the fact that on selfing of hermaphrodite forms dioecious unisexual individuals segregate out. Genetically the hermaphrodite vines represent males and may be either XY or YY in constitution, while the females are XX. In the hybrid generation from *Vitis vinifera* hermaphrodite x *Riparia* segregation for sex was according to the homo-heterogametic scheme; and the occurrence of males and hermaphrodites in the F_1 hybrids could be interpreted on the basis that all males were of the constitution X_{vi} Y_{Ri} and the hermaphrodites, X_{Ri} Y_{vi}. An analysis of *Vinifera-Rupestris* hybrids however shewed that in the latter species the male is XY and the female XX but the occurrence of XX (and possibly also YY) hermaphrodites in the F_1 generation necessitates the assumption of a polyfactorial as well as a monofactorial basis for sex determination in this cross.

The theoretical aspect and possible mechanisms of sex determination in the vine are discussed with special reference to the action of realisators and the various existing theories of sex determination in different organisms; and a factorial interpretation in accordance with Kosswig's views on the sex determining mechanism in carp is adopted. On this basis while the Y chromosome carries a sex realisator the X chromosomes play no part in sex determination, and an autosomal complex of sex determining factors promotes the development of the female (or male) sex organs. Hermaphrodites arise by the mutation of the male sex realisator, a to a^1, 2 a^1 not being much more potent than a^1, for stocks with a^1a^1 are hermaphrodites. Selfed YY hermaphrodites may produce males as a result of heterozygosity of the autosomal F or M complex. Polyfactorially determined bisexual hermaphrodites of the constitution YY occur in *V. vinifera* x *V. rupestris* crosses. Confirmatory evidence for these statements was obtained from the back-cross of the F_1 species hybrids to *Vinifera*.

The economic applications of such data on sex determination are briefly indicated with special reference to the value of ensuring that at least one parent of a cross shall be a YY hermaphrodite and thus give an entirely hermaphrodite progeny; and its use also in back-crosses.

1340. Pirovano, A. 634.835:581.145:575

La genetica ai limiti fisiologici di produttività della vite. (**Genetics at the physiological limits of production in the vine**).

Ital. Agric. 1938 : **75** : 175–81.

The extremes, sterility and over-production, occur in the progeny of certain hybrid crosses. As an illustration of extreme over-production the genealogy is given of a cross between Angelo Pirovano (1899) x Ciclopica (1912) and 35 of the resulting progeny are briefly described. For the ultra-production of these special treatment is necessary, and the author suggests that

breeding for high-production, the products of which demand special treatment, would be better replaced by an effort to obtain the greatest harmony between the environment and the local cultural practices.

1341. KACZMAREK, A. 634.835:581.162.3:577.81
Zur Frage der Keim- und Befruchtungsfähigkeit des Pollens der weiblichen Rebenblüte. (**On the question of the germination and fertilization capacity of the pollen of the female flower of the vine**).
Gartenbauwiss. 1938 : **11** : 483–522.

Tests of the germination capacity on artificial media of pollen of 235 female varieties of vines and also the results of extensive pollination experiments in the open shew that the pollen of ♀ varieties of the vine is completely sterile.
The relevant literature and results of other workers is fully and critically discussed with notes on the necessary precautions in any investigation of the problem in question.
Incidentally the infertility of "female" pollen is tentatively attributed to the action of a homozygous gene inhibiting pollen development.

1342. SARTORIUS, O. 634.835-1.557:575.11
Vererbungsstudien an der Weinrebe mit besonderer Berücksichtigung der Vererbungsweise der Fruchtbarkeit. (**Inheritance studies on the vine with special regard to the inheritance of fruitfulness**).
Z. Zucht. 1938 : A **22** : 303–16.

During 1920–1922 a large number of self-pollinations were made of the two *Vitis vinifera* varieties, green Silvaner and red Traminer. Of the 15,000 plants obtained hardly any two resembled each other and the weakening effect of inbreeding was very marked.
Crosses were made between these two varieties and between Traminer and certain French hybrids. As regards colour of the grapes, it can only be said that white is recessive to coloured and that the colour factors are either not very numerous or are closely linked.
There was considerable segregation for shape and size of berries and density of the bunches. There was no correlation between the last two characters.
The length of the stems of the bunches shewed transgression in one cross and in another the dominance of the long stem over the short.
The amount of good flower formation as opposed to flower abortion varies in degree but the different degrees are inherited. Crosses give more progeny with good flower formation than do self-pollinations.
Time of ripening was more or less constant in the progeny of some self-pollination but in others later ripening forms occurred.
Some observations were made on the shape of the grapes; the progeny of the self-pollinations of Silvaner and Traminer so closely resembled the parental variety that homozygosity is assumed. The results of crossings were very irregular.
Quality in the progeny of the Silvaner self-pollinations was very uniform but there was segregation for sugar content and for degree of the characteristic Silvaner bouquet.
The quality of the Traminer self pollinations varied from good to very good but in crosses the typical flavour had not reappeared in the F_2. In the crosses with Riesling on the other hand the Riesling bouquet and the closely related muscat flavour frequently turned up. The size of the grape decreased very markedly after both crossings and self-pollinations as also did the fruitfulness.
The question of the fruitfulness of cultivated plants that are usually vegetatively propagated is discussed.

FORESTRY 634.9

1343. FUNK, G. 634.972.1:575.061.633
Über die Nachkommenschaft einer weiss-bunten Eiche (*Quercus robur, albi-viridinervis*). [**On the progeny of a green and white variegated oak (*Q. robur, albi-viridinervis*)**].
Beih. bot. Zbl. 1938 : **58** : A151–63.

Of the progeny of the variegated oak, 29 per cent was variegated with all degrees from nearly pure green to white and these variations are described. The growth of the variegated

seedlings is much less vigorous than that of the normal green seedlings and under normal conditions would soon be suppressed.

1344. Sipkes, C. 634.972.1:575.42:575.3(49.2)
Eiken. (**Oaks**).
Tijdschr. Ned. Heidemaatsch. 1938 : **50** : 162–64.
A brief note on various species and types of oaks considered from the standpoint of their adaptation to conditions in parts of Holland. By repeated selection it should be possible to obtain races suitable for the dune regions.

1345. Melander, Y. 634.972.3:576.356.5
A new giant *Populus tremulus* in Norrbotten.
Hereditas, Lund, 1938 : **24** : 189–94.
A brief account of a triploid aspen found in the province of Norrbotten. The trees are male, exhibit *gigas* characters, produce a single, straight main stem and their wood appears to be resistant to infection by *Polyporus*.

1346. Walker, R. I. 634.972.8:576.312.35:581.33
Macrosporogenesis and embryo development in *Ulmus fulva*.
Bot. Gaz. 1938 : **99** : 592–98.
Incidentally 15 bivalents are recorded as appearing at meiosis in the ovule.

1347. Goidànich, G. 634.972.8-2.42-1.521.5:575.42
Notizie sulle ricerche di selezione di olmi resistenti alla grafiosi. (**Notes on researches in the selection of elms resistant to elm disease**).
Ital. Agric. 1938 : **75** : 69–74.
Several different species of elms and hybrids and seedlings were investigated for resistance to *Ceratostomella ulmi* (*Graphium ulmi*).
The common elm, *U. campestris* was uniformly susceptible. The behaviour of *U. montana* was variable. Some examples of *U. laevis* shewed a striking resistance.
U. americana was very susceptible. *U. pumila*, whether the pure species or hybrids, on its own roots or grafted was also very variable in its behaviour and it is concluded that this species is resistant but not immune to the disease.
Of ten trees of the variety Cr. Buisman, selected by Dutch phytopathologists from an elm of Spanish origin, inoculation caused only the slightest traces in seven. In ten others, grafted on *U. pumila* there were no pathological symptoms. Some other foreign species and ornamental varieties were also tested and fuller results will appear later.

1348. 634.973:575.127.2
Rare tree. Hybrid ash discovered.
Serv. Lett. Penn. Dep. For. Waters 1935 : Ser. 6, No. 34 : p. 2.
A brief note mentioning the discovery of a natural hybrid mountain ash, *Sorbus Aucuparia* x *intermedia* in Pennsylvania.

1349. Behrndt, G. 634.975:575.42(43)
Die züchterische Bearbeitung der Kiefer. (**Breeding work with pines**).
Umschau 1938 : **42** : 174–76.
The two main aims in Germany are the increase in mass production over the surface area and the improvement of the quality of the wood. The results of individual selection shew how much can be accomplished by this method, and the possibility of combining the two is discussed.

1350. 634.975:576.16
Seitz, D. 634.975:581.44:575
Die Kiefernrassenzucht in Theorie und Praxis. III. (**The production of races of Scots pine in theory and practice. III**).
Mitt. Forstwirt. Forstwiss. 1937 : **8** : 577–84.
The author's views, expressed in earlier papers and reviewed in "Plant Breeding Abstracts", Vol. VII, Abst. 793 and Vol. VIII, Abst. 656 have been criticized by Dengler and in this paper the author upholds and strengthens his position by further observations and measurements of various races of Scots pines.

1351. Temple, C. E. 635-2-1.521.6:575(73)
Disease resistance in horticultural crops.
Trans. Peninsula Hort. Soc. 1937 : **27** : No. 5 : 150–58.
A popular account of American work on breeding disease resistant vegetables, including peas, water melons, cabbages, tomatoes, potatoes, cucumbers and spinach.

1352. 635.13:575(48.5)
Svensson, V. 635.13 Regulus
Weibulls original Regulus. En ny morotsort. (**Weibulls original Regulus. A new variety of carrot**).
Weibulls Ill. Årsb. 1938 : **33** : 33–36.
The new carrot, Regulus, is described. It originated from the Dutch variety Giganta and has given satisfactory results in variety trials.

1353. Rosenthal, C. 635.48:581.162.5
Über Selbststerilität des medizinischen Rhabarbers (*Rheum palmatum*).
[**On the self-sterility of medicinal rhubarb (*R. palmatum*).**]
Z. Zücht. 1938 : A **22** : 317–22.
Rheum palmatum is the rhubarb used for medicinal purposes. Experiments on the self-sterility of the plant shewed that there exist both self-fertile and self-sterile races as well as intermediate forms. It is suggested that the more rapid rate of growth of the foreign pollen is probably the cause of the apparent self-sterility.

1354. 635.61/3-2.483-1.521.6
Layton, D. V. 635.615-2.483-1.521.6:575.11
The parasitism of *Colletotrichum lagenarium* (Pass.) Ell. and Halst.
Res. Bull. Ia Agric. Exp. Sta. 1937 : No. 223 : 37–67.
Varietal tests for resistance to anthracnose of cucurbits were performed with watermelons (*Citrullus vulgaris*), cantaloupe (*Cucumis melo*) cucumber (*Cucumis sativus*) and pumpkin and squash (*Cucurbita pepo*, *C. moschata* and *C. maxima*). In commercial varieties of watermelon, cantaloupe and cucumber slight differences in resistance were found, too small to be of commercial value. Very resistant forms were found among inedible American citron varieties (*Citrullus vulgaris* var. *citroides*) and five African varieties of watermelon, including three edible varieties, were also very resistant.
The edible African varieties were susceptible to wilt and had small fruits with flaccid flesh. By hybridization with the wilt-resistant varieties, Iowa Belle and Iowa King, strains have been produced which are homozygous for resistance to anthracnose and to wilt. These strains have been crossed with other wilt-resistant varieties of better fruit qualities than Iowa Belle and Iowa King, to improve their fruit quality. It was found that the anthracnose resistance of the African varieties was inherited as a simple Mendelian dominant and breeding for resistance to this disease should therefore be an easy task.

1355. Weetman, L. M. 635.615:575.11
Inheritance and correlation of shape, size and color in the watermelon, *Citrullus vulgaris* Schrad.
Res. Bull. Ia Agric. Exp. Sta. 1937 : No. 228 : 223–56.
The varieties used in this investigation were as follows:—Long Iowa Belle, with elongate, medium-large fruits, seeds light-tan with a black peripheral band, rind medium dark green with a distinctive greenish-white mottling; Round Iowa Belle, similar but with spherical fruits; Japan 4 (Yamota suika), nearly spherical, small fruits, very small, brown seeds, very light yellowish-green rind; Japan 6 (Shashi), nearly spherical small fruits, reddish-brown seeds, light green rind with an inconspicuous line stripe; China 23, spherical fruits, seeds light-tan with a dark band, rind with alternating stripes of light and dark green with a network running through the dark stripe. The crosses studied were Long Iowa Belle x Round Iowa Belle, Long Iowa Belle x Japan 6, Long Iowa Belle x Japan 4, Long Iowa Belle x China 23 and Japan 6 x China 23; reciprocal crosses were made in all cases. F_1, F_2 and back-cross populations were studied.

Fruit shape was determined by a single pair of factors, acting without dominance. Ovary shape was highly correlated with fruit shape and was determined by the same factors.
Fruit weight was found to be determined by several factors. If the data were plotted arithmetically there appeared to be dominance of small weight, but if they were plotted logarithmically there was no evidence of dominance. Correlation studies shewed an association of high fruit weight with elongate fruit shape, suggesting a gene for fruit size linked with that for fruit shape. The correlation coefficients between days to flowering, days to maturity and length, width, shape and weight of fruit are given.
In the cross Long Iowa Belle x Japan 4 seed weight was determined maternally by one major factor pair with small size dominant; modifying factors are postulated to explain divergences from the expected ratios. The difference in seed size in the parents caused a difference between reciprocal hybrids, those with Japan 4 as mother being later.
The inheritance of rind colour is most simply explained in terms of multiple allelomorphs, *D* for dark colour, d^s for striping and *d* for light colour, in that order of dominance. The netting of China 23 was dominant to the line-stripe of Japan 6, with a single factor difference. The mottling of Iowa Belle was determined by a single recessive factor, though in the cross with Japan 6 the heterozygotes could be distinguished. This factor was linked with the multiple allelomorph series for rind colour, the estimates of crossing-over being 39·9 ± 4·3, 33·8 ± 4·6 and 33·7 ± 4.7 per cent. The factor for Iowa Belle mottling was also found to be associated with high fruit weight. There is thus evidence of two size genes located on different chromosomes.
The peripheral black band on the seeds is considered to be produced by a single dominant factor; reddish-brown is considered to be a simple dominant over light-tan and the combination of these two dominant factors is regarded as giving black over the entire seed coat.

1356. 635.615-2.484-1.521.6:575
635.615 Klondike R7
PORTER, D. R. 635.615 Klondike R16
Breeding high-quality wilt-resistant watermelons.
Bull. Calif. Agric. Exp. Sta. 1937 : No. 614 : Pp. 43.

The aim of the work described was to breed a watermelon variety combining resistance to wilt (*Fusarium niveum* E.F.S.) with the high quality of the Klondike.
A brief history of the development of wilt-resistant watermelons is given. None of the resistant varieties available had good enough fruit quality to replace Klondike.
By selection on wilt-infested ground, two resistant strains were developed from Klondike and one from Grey Monarch. One of the former has been named Klondike R16, but none of them has been released.
In breeding by hybridization, citrons and the watermelon varieties Conqueror, Iowa Belle, Iowa King and Pride of Muscatine were used as resistant parents. Conqueror is derived from the cross citron x Eden watermelon while Iowa Belle and Iowa King result from open-pollinated seeds of Conqueror; Pride of Muscatine is a selection from Kleckley Sweet. Various strains of Klondike were used as susceptible parents. Iowa Belle was found to be the best resistant parent from the point of view of fruit quality in the progeny and it was from the cross Iowa Belle x Klondike that the resistant variety Klondike R7 was derived. The F_1 was grown in wilt-free soil, resistance being recessive. Succeeding generations were grown in wilt-infested soil to ensure selection for wilt-resistance and selection for fruit quality was carried on at the same time. In this connexion it is mentioned that a refractometric method was found useful in measuring total soluble solids; the readings thus obtained tend to correlate with relative sweetness. Seed from three resistant plants of an F_5 family, with satisfactory fruit qualities was bulked to form the foundation stock of the new variety, Klondike 7, which was released in 1937 after extensive tests in different parts of California. It has been crossed with Striped Klondike to produce a sweeter, resistant, green skinned type and a resistant, striped type.
With regard to the commercial production of seed of Klondike R7 it is recommended that seed crops should be grown on wilt infested soil, to eliminate susceptible plants and also that attention should be paid to the eradication of wild citron plants in the vicinity of the crop.

No data are given on the inheritance of wilt resistance and it is pointed out that owing to the method of cultivating watermelons, in which 10 or 20 seeds are planted per hill with subsequent thinning to one plant, resistance percentages are of doubtful significance.

1357. Erwin, A. T. 635.62(76.4)
An interesting Texas cucurbit *Cucurbita pepo*, L. var. *ovifera* Alef. (*C. texana*, Gray).
Iowa St. Coll. J. Sci. 1938 : **12** : 253–61.
This plant, which is considered indigenous by the present author, though other workers have deemed it an escape, is closely related to the ornamental gourds. In view of the archaeological evidence that *Cucurbita Pepo* existed in this region in very ancient times, it is suggested that this wild cucurbit may be the prototype of our cultivated forms of *C. Pepo*.

1358. Yeager, A. F. 635.64:575(78.4)
Early tomatoes.
Trans. Ia Hort. Soc. 1935 : **70** : 266–68.
It is mentioned that three new strains produced and sent out for testing by the North Dakota Agricultural Experiment Station are characterized by a determinate habit, the earliness and productiveness of Bison, with better shaped fruit and without the green stem spot characteristic of this and other commercial varieties.

1359. Humphrey, L. M. 635.64:575.127.2:576.354.46
Chromosome behaviour in the species cross *Lycopersicum esculentum* x *L. pimpinellifolium*.
Proc. Iowa Acad. Sci. 1935 : **42** : 93–94.
The somatic chromosomes are in the form of small rods with median and sub-median constriction, those of *L. esculentum* being distinctly larger. Pairing between all sets occurs at pachytene of meiosis but on some chromosomes there are places that never become paired but have loops or free ends.
Univalents are sometimes seen at diakinesis but not at metaphase though occasional lagging causes the non-inclusion of one or more univalents which may account for the 15–20 per cent sterility observed in the hybrid.

1360. Sirks, M. J. 635.652:575.182
A case of bud variation in *Phaseolus* caused by a transitory plasmatic change.
Genetica 1938 : **20** : 121–58.
A plant of *Phaseolus vulgaris* in 1925 produced three pods of which two were shorter and narrower than the third. Plants were raised from the seeds of all three pods and it was found that the differences were inherited. The differences were even clearer in the next generation, obtained by selfing, but in succeeding generations they diminished and disappeared by the fifth to eighth generations. A similar gradual disappearance of the differences was noted after crossing the different lines. This phenomenon is considered to be due to a transitory plasmatic change (Cf. "Plant Breeding Abstracts", Vol. VIII, Abst. 671).

1361. Lamprecht, H. 635.652:575.242:581.45
Über einen *Phaseolus*-Typus mit abwärts geneigten Blättern und seine Vererbung. (**On a *Phaseolus* type with downwardly bent leaves and its inheritance**).
Bot. Notiser 1937 : 341–54.
A type of *Phaseolus* with downwardly inclined leaves is described. The inflorescences were, however, upright. When crossed with the normal type the so-called *declivis* type proved to be dominant and was inherited as a simple mendelian character *Sur-sur* independent of the genes *Arg.* (silver pod colour), *P* and *V* (both for flower colour).
It is assumed that this is a case of a dominant mutation. The author has found the type six times among his breeding material of 300,000 individual plants.

1362. Norton, H. W. 635.652:581.49:519.24
Note on Smith's paper on stoma number.
Amer. J. Bot. 1938 : **25** : p. 216.

Smith, H. B.
Note on Smith's paper on stoma number.
Ibid. 1938 : **25** : p. 217.
In the first note several criticisms of Smith's use of the analysis of variance in the paper reviewed in "Plant Breeding Abstracts", Vol. VIII, Abst. 672 are advanced. The validity of these criticisms is admitted by Smith in the second note.

1363. 635.652-2.452-1.521.6
Townsend, G. R. 632.452:576.16
Reactions of varieties of snap beans to rust.
Plant Dis. Reporter 1938 : **22** : 2–4. (Mimeographed).
The reactions of several bean varieties to *Uromyces phaseoli typica* at different localities, in Florida, Georgia, Maine, and Virginia are given. Considerable differences in reaction at different localities indicate physiological specialization of the parasite. The varieties tested included some selections from brown seeded Kentucky Wander beans, made by the Ferry Morse seed company on the basis of rust resistance; only one of these, 6651, was highly resistant or tolerant in all the localities where it was tested.

1364. 635.652-2.8-1.521.6:575(79.6)
Murphy, D. M. and 635.652 Red Mexican U.I.3
Pierce, W. H. 635.652 Red Mexican U.I.34
A mosaic-resistant small red bean.
Phytopathology 1938 : **28** : 270–73.
The Plant Pathology department of the University of Idaho has for several years conducted a breeding programme for resistance to the virus disease, common bean mosaic, and has developed and introduced four resistant strains of Great Northern beans, U.I. 1, U.I. 81, U.I. 59 and U.I. 123; the last three together now make up almost the entire crop of Great Northern beans in Idaho.
In Twin Falls and adjacent counties where the beet leaf hopper, *Eutettix tenellus*, is prevalent, the Red Mexican variety of beans is grown, because of its resistance to curly top. It is susceptible to common mosaic, which causes severe losses every year.
To develop a Red Mexican strain resistant to common mosaic and at the same time a Great Northern strain resistant to curly top, several reciprocal crosses were made in 1929 between Red Mexican and Great Northern U.I. 1. By selection in two areas where curly top and common mosaic respectively were severe, two Red Mexican strains have been developed which are resistant to both diseases. They have been named Red Mexican U.I. 3 and Red Mexican U.I. 34. They are very similar to Red Mexican but have seed coats of a darker red and foliage of a lighter shade of green.

1365. Morse, W. J. 635.655:575
Soybean varieties and their utilization.
Proc. 37th Annu. Convent. Ass. S. Agric. Wkrs, Jackson, Miss., 1936 (1937) : 64–65. (Abst.)
In view of the great variety of uses of the soya bean, there is a very wide field of plant breeding work with this crop. The selection of a suitable variety is considered to be the most important single factor for the success of the soya bean.

1366. Woodworth, C. M. and Williams, L. F. 635.655:575.11.061.633:539.16
635.655:575.116.1
Recent studies on the genetics of the soybean.
J. Amer. Soc. Agron. 1938 : **30** : 125–29.

Descriptions are given of five new chlorophyll deficient types which behave as simple recessives. They are all viable but with different degrees of reduction in vigour. One of them y_4 appeared in the progeny of a plant grown from seed treated with radium.

New linkage relationships are described as follows:—T–t (tawny vs. grey pubescence) and D_1–d_1 (yellow vs. green cotyledon colour) with 13 per cent crossing over; G–g (green vs. yellow seed coat) and D_2–d_2 (yellow vs. green cotyledon) with 13 per cent crossing over; p_2 (glabrousness) and de_2 (defective seed coat) with about 2 per cent crossing over; r_1–$r_1{}^c$ (brown coat vs. reddish-brown coat) and M–m (mottling vs. self colour) with 30 per cent crossing over. This last result shews that the genes m, p_1, and r_1 lie in that order.

Provisional maps of four chromosomes are given, as follows:—Chromosome 1, (t, r_2, de_1)–6–e–7–d_2; chromosome 2, m–18–p_1–12–r_1; chromosome 3, g–13–d_1; chromosome 4, de_2–2–p_2.

It is mentioned that f (fasciation) appears to be associated with late maturity and may lie on chromosome 1.

1367. 635.656:575(47.1)
635.656 Koivisto
Pesola, V. A. 635.656 Artturi
Tvenne nya ärtförädlingar, Koivisto och Artturi. (**Two new improved peas Koivisto and Artturi**).
Medd. Stat. Lantbruksförsök, Helsingfors 1935 : No. 90.

The plant-breeding department of the Agricultural Experiment Station has put on the market the green culinary pea Koivisto selected from a line of a land variety from East Finland and the mottled forage pea Artturi from a cross between the Danish forage pea Marmorerad Glenø and an indigenous forage pea from West Finland. Both varieties have done well in comparative trials.

1368. Akerberg, E. 635.656:575(48.5)
Några resultat från förädlings- och försöksverksamheten med foderärter vid Weibullsholm. (**Some results of breeding and research work with fodder peas at Weibullsholm**).
Weibulls Ill. Årsb. 1938 : **33** : 17–22.

An account of breeding for improved fodder peas with descriptions of some of the more important varieties.

1369. 635.656:575(48.5)
Lamprecht, H. 635.656 Apollo
Weibulls Apollo. En ny typ av ärter : brytmärgärter. (**Weibull's Apollo. A new type of pea : snap marrow pea**).
Weibulls Ill. Arsb. 1937 : **32** : 35–37.

The Apollo pea represents a new type, the combination of the snap pea type with the seed of the marrow type and originated from the cross between Vilmorins Original Roi des Gourmands and Weibull's strain 50 of Witham Wonder. It is high yielding and of good quality.

1370. Sousa Bourdouil, C. 635.656:575.11.061.6:581.48
Sur les hybrides entre *Pisum sativum* L. et *P. Jomardii* Schrank. (**On the hybrids between *P. sativum* L. and *P. Jomardii* Schrank**).
Bull. Soc. Bot. Fr. 1936 : **83** : 69–71.

In crosses of *P. Jomardii* ♀ x *P. sativum* ♂ (var. Le Délicieux) the F_1 resembled the mother plant. In the reciprocal cross the progeny resembled *P. sativum* except that the seeds were smooth instead of wrinkled. These seeds gave plants intermediate in height with red flowers and seeds with a light brown hilum and a dark green seed coat dotted with violet. This last is

a new character. In the F_2 the segregation of colour of the seed coat was: dotted with violet 207; not dotted 60; dark green 138; light green 58. The character violet dot approaches a 3 : 1 ratio and differs from the results of Tschermak who found a 9 : 7 ratio.
Two kinds of light green seed coat were found, one like *P. sativum* does not brown after treatment with dilute nitric acid and diluted soda and the others, shewn by some hybrids of *P. Jomardii* with *P. sativum* which does shew the browning after treatment.

1371. 635.656:575.12
AAMISEPP, J. 635.656 Jõgeva Green
Jõgeva roheline söögihernes. (**The new culinary pea variety, Jõgeva Green**).
Agronoomia 1937 : No. 5 : Pp. 24.
The "Jõgeva Green" pea was obtained at the Jõgeva Plant Breeding Station, Estonia, in 1924 by crossing Grasshoffs "Regenta" by Werthers "Jenaer Victoria." This new variety was compared with Svalöfs "Concordia" (which, under Estonian conditions, is the highest yielding and best flavoured variety) and with two local varieties of unknown origin.
Trials of 5 years' duration, in which the yield of peas and straw, and also the qualities of the seed were evaluated, have shewn that the yield of grain of "Jõgeva Green" has surpassed all our old varieties by 14–22 per cent which represents a difference of 231–328 kg per ha.
As regards size of the grain (256 gr) the "Jõgeva Green" surpasses the others, especially the old varieties.
In taste the new variety ranks equal with the old "Estonian gray pea" of approved quality, surpasses the "Estonian yellow pea," but is considerably inferior to "Concordia".
Jõgeva Green ranks with the medium late to late varieties, requiring 97 days for ripening. The stems are tall, on the average 113 cm (fluctuating between 65–177 cm).
The number of pods is comparatively small, but they are very large and occur in pairs. They are long, pointed and slightly curved.
They are also well filled and the peas are large, round or slightly oval, greyish-green, smooth.
To judge by the results of the trials hitherto, it can be assumed that the "Jõgeva Green" as a culinary pea with its high yield of grain, its larger grains and greater resistance to bad autumn weather conditions will succeed in replacing our old varieties. M. P.

1372. RASMUSSON, J. 635.656:575.242
635.656:575.243:537.531
Notes on some mutants in Pisum.
Hereditas, Lund, 1938 : **24** : 231–57.
The character, origin and segregation of some new mutant types in *Pisum* are described. They include 9 chlorophyll mutants, a mutant (f_f) with funnel-shaped leaflets and two ultra-dwarf types (l_m and l_o). One of the chlorophyll mutants and the f_f mutant are the result of X-ray treatment.

1373. WENT, F. W. 635.656–1.541:577.17:575
Transplantation experiments with peas.
Amer. J. Bot. 1938 : **25** : 44–55.
The author has postulated a new category of growth hormones, the calines which come from the base of the plant and move only through living tissues. Tops of etiolated pea shoots were grafted on root systems, with attached cotyledons, of the same or other varieties of peas. The growth of the grafted tops depends on the success of the graft, on the specific reactivity of the top and on the supply of calines from the base. Different varieties used as root stocks differed in the absolute and relative amounts of calines affecting stem elongation, leaf growth, stipule growth and petiole growth. The differential effects produced in these respects by different rootstocks on the scions made it possible to recognize the base on which a given top had been grafted.
The importance of linking up this type of work with genetical work on growth is indicated.

1374. Goluš, B. M. 635.656-2.111-1.521.6:576.341
Permeability of plasma as a factor of resistance to cold.
C.R. (Doklady) Acad. Sci. U.R.S.S. 1938 : **18** : 363–66.
The author finds that the increase in permeability of the protoplasm of pea varieties on freezing is correlated with their susceptibility to cold.

1375. Johnson, I. J. and 635.67:581.48:575.11.061.5
Hayes, H. K. 633.15:581.48:575.11.061.5
The inheritance of pericarp tenderness in sweet corn.
J. Amer. Soc. Agron. 1938 : **30** : 220–31.
In the cross between an inbred line with a tough pericarp and an open-pollinated variety with very tender pericarp, evidence for multiple factor inheritance of pericarp tenderness was obtained. In an F_2 of 430 plants the limits of both the tough and the tender parents were just transgressed. Among 34 F_3 lines only one had as tender pericarp as the tender parent, while 16 out of 42 first year selfed lines from the first back-cross to the tender parent were as tender as the latter.
Selection for tenderness in successive back-crosses to the tough inbred line maintained the same range in distribution for tenderness as occurred in the first back-cross to this parent. It therefore appears that the inheritance of tenderness is simple enough to allow of transferring the character by the back-cross method.
The tender parent has white endosperm and a cross was made with a Golden Bantam inbred line to transfer the gene for yellow endosperm. Selection for tenderness in the successive back-crosses to the tender parent resulted in nearly complete recovery of the parental genotype in two back-crossed generations.
Tenderness was measured by resistance to puncture and it was found that the puncture index increased rapidly with days after pollination and also with days between silk emergence and pollination. In the present studies the tests were made 20 days after hand-pollination or 20 days after silk emergence in open-pollinated ears.

BOOK REVIEWS

MADSEN-MYGDAL, T. 03:63
Landbrugets ordbog. **(Agricultural dictionary).** Gyldendalske Boghandel, København 1938 : 3rd ed. Vol. 2 : Pp. 719. illus.

Volume I of this excellent and well illustrated agricultural encyclopaedia has already been reviewed in "Plant Breeding Abstracts", Vol. VIII, p. 300.

TIPPETT, L. H. C. 519.24
The methods of statistics—an introduction mainly for experimentalists. Williams and Norgate, Ltd., London 1937 : 15s. 0d. 2nd ed. Pp. 280. 11.9 tables. 13 figs.

This is a very readable book on the methods likely to be required by the applied statistician, who is not very much concerned with either the logical foundations of the subject, or with mathematical proofs of the theorems needed for the establishment of the methods. Indeed, it must be regarded as the most up-to-date textbook on the subject generally, for since the first edition appeared in 1931 it has been drastically revised in places, and now incorporates discussions of, among other topics, the Neyman-Pearson theories of statistical inference, and Fisher's theories of fiducial probability and estimation, the last-named including the method of maximum likelihood. The author has boldly cut out certain tests of significance, e.g., for the correlation ratio, because the desired result can be attained in a simpler way, together with a whole section on the intra-class correlation coefficient, which is now only of historical interest. The first three chapters, dealing with frequency distributions and constants, distributions derived from the theory of probability, and errors of random sampling and statistical inference, have been entirely rewritten, and in other places considerable additions have been made, for example, in dealing with sampling tests of regression, and the principles of experimental arrangements. This last subject is of particular interest to the agriculturist, although its industrial applications are also illustrated, and the student will welcome the additions, particularly those dealing with multiple factor experiments and the analysis of covariance.

The result is a very much better book, in which nearly everything that is likely to be needed by the statistical worker will be found. Slips occurring in the earlier edition have been corrected, and there are numerous examples. The only weakness relates to certain mathematical proofs. The author has thought it desirable to give some proofs, but his attempts, e.g., to derive the joint distribution of the mean and variance, leaves the problem very much in the air, for he leaves off when the proof becomes difficult. If it is of value to give the form of Fisher's z-distribution, it is surely of equal value to give that of "Student's" t! The absence of tables is still a handicap, but that will be remedied when the long-heralded tables of Fisher and Yates appear.

J. W.

WAUGH, A. E. 519.24
Elements of statistical method. McGraw-Hill Publishing Co., Ltd., London 1938 : 21s. 0d. Pp. xv + 381. 43 figs. 77 tables.

This book is written in what has become by now the traditional style of the College Textbook of Statistics in America. It is intended for the general reader, and therefore steers a middle course between mathematical proofs of theories and no proofs at all. It goes into great detail concerning the frequency distribution and measures of central tendency and dispersion, shews how a normal curve is fitted to data, and then collects together a large number of measures of reliability, in the shape of standard and probable errors of various statistical constants, with little consideration of whether such measures are appropriate or not. Such attention as is called to the special treatment of small samples—for example, on page 152 in the formula $\sigma N = \frac{\sigma x}{\sqrt{N}}$ it is stated that we should divide by $\sqrt{N-1}$ instead of by $\sqrt{N}$—suffers from lack of adequate explanation. Later in the book, however, after trends and index numbers have been studied, the proper test for the significance of a correlation coefficient is given in place of the old probable error test. When it comes to curvilinear and multiple

correlation, while the description of the necessary calculations is all that could be desired, the treatment of the significance tests is weak. Thus, on pages 315 and 335, the old standard error formulae are quoted somewhat half-heartedly, and the nearest the author gets to an appropriate test is to say (page 315) "it is possible that the reliability of the curvilinear regression line could be determined by methods called 'analysis of variance', but these methods are too advanced for us to take up here". It is not only "possible", but certain, that such methods give what is wanted, and they are not too advanced for textbooks of this nature, when, as happens elsewhere throughout this book, they are given without formal mathematical proof, and illustrated arithmetically. J. W.

Scott, C. M. 537.531:575.243
Some quantitative aspects of the biological actions of X and γ-rays.
Spec. Rep. Ser. Med. Res. Coun., Lond. 1937 : No. 223 : 1s. 6d. Pp. 99 + xiv. 21 figs.

This rather comprehensive account of the biological action of short-wave radiations contains a section on the genetic effects of X- and γ-rays.

Tschulok, S. 575/577:007
Lamarck. Eine kritisch-historische Studie. (**Lamarck—a critical historical study**). Max Niehans, Zürich and Leipzig 1937 : RM. 3.† Pp. 190.

This is a critical study of Lamarck's work and examines in some detail his various writings, which include papers on chemistry, physics and climatology besides his botanical and zoological work. Lamarck, besides an acute power of observation, was possessed of a superabundance of ideas, and the fact that he knew little or nothing about a subject did not hinder him from writing about it. As his work had little or no relation to current theories and often no greater relation to the facts even as then known, it is hardly surprising that his writings were not seriously considered by the scientists of his time. His famous theory of evolution is fully discussed, its originality and its weaknesses analysed and the value of Lamarck's contributions to scientific thought is estimated.

575:633
Yearbook of agriculture.
Yearb. Agric. U.S. Dep. Agric. 1937 : $2·00 : Pp. 1497. illus.

The United States Yearbook of Agriculture for 1937, with the exception of the first 116 pages, containing the Secretary's report to the President, is devoted to an account of breeding work with animals and plants. This concludes the "survey of superior germ plasm" begun in the 1936 Yearbook (Cf. "Plant Breeding Abstracts", Vol. VII, Abst. 251) and is on similar lines. The crops dealt with are as follows:—tomatoes, peppers and eggplants, cucurbits, onions, peas and beans, leafy Cruciferous vegetables, root vegetables, salad crops, sweet corn, popcorn, potatoes, strawberries, blackberries and raspberries, currants and gooseberries, *Actinidia*, cranberries, *Eleagnus*, *Chaenomeles* and bush cherries, blueberries, apples, pears, grapes, stone fruits, *Citrus* fruits, nuts, flowers, miscellaneous forage and cover crop legumes, miscellaneous grasses, timothy, lucerne, soya beans, clover, hops and forest trees. The articles are each divided into two parts, the second part being concerned with genetics and cytology and intended for the more technical reader, the first part being of more general interest. There are also general articles on vegetable breeding, on the fundamentals of heredity for breeders, and on vegetative reproduction, a chronology of genetics, an index and a summary of the articles. As it stands the volume contains over 1,500 pages and two complete articles have had to be omitted because of limitations of space. These are on subtropical fruits other than *Citrus* and on the chromosomal basis of heredity. Along with the articles on flower breeding and forest tree breeding complete with bibliographies they can be obtained from the Superintendent of Documents, Washington, D.C. The bibliographies of the articles on flowers and forest trees have been omitted from the Yearbook owing to their great length. The Agricultural Statistics for 1937 are published separately.

† 25 per cent reduction outside Germany.

The present volume maintains, if it does not surpass, the high standard set by the 1936 Yearbook and the two together are a most valuable contribution to genetical literature. A more comprehensive account of the economic applications of genetics it would be difficult to imagine. Other features which must be mentioned are the high standard of accuracy, the concentrated information on varieties, chromosome numbers, aims and methods of different stations given in tabular form, the attractive illustrations and the very low price.

575.1

Genetics. Curr. Sci. (Special number) March, 1938 : Rs. 2 (or 3s. 0d.) Pp. 39. 3 figs. 2 tables.

The third of the special numbers published by the Indian monthly, "Current Science", is devoted to genetics. The material has been arranged for the press by Dr E. W. Erlanson Macfarlane, who also contributes an introduction. The following articles appear:—

H. J. Muller. *The present status of the mutation theory.* (*pp. 4–15*).

This paper has already been reviewed from the Russian (Cf. "Plant Breeding Abstracts", Vol. VII, Abst. 523).

Ö. Winge. *Cytology of sex.* (*pp. 16–19*).

A brief review of the work on sex chromosomes, mainly in animals, including an account of the author's transformation of autosomes into sex chromosomes in *Lebistes*.

H. Kihara. *Cytogenetics of species hybrids.* (*pp. 20–23*).

A summary based chiefly on the author's wheat hybrids. The relevant work has been reviewed in "Plant Breeding Abstracts".

H. B. Frost. *The genetics and cytology of Citrus.* (*pp. 24–27*).

Two kinds of polyembryony occur in *Citrus*, the more common being nucellar embryony, the rarer type being the production of identical twins in the generative progeny. Young clones shew juvenile characters such as vegetative vigour and extreme thorniness, whether derived from generative or nucellar seedlings.

The normal somatic chromosomes number in all species and varieties of *Citrus* is 18. The same is true of *Poncirus*, *Fortunella* and four closely-related genera, *Citropsis*, *Severinia*, *Triphasia* and *Aeglopsis*, except that *Fortunella hindsii* (Champ.) Swingle has 2n = 36. *Citrus* varieties cultivated at Riverside, California, produce occasional nucellar seedlings with 2n = 36, and these, by crossing with normal diploids, give rise to triploids. These polyploids differ externally from the diploids, have irregular meiosis and shew varying degrees of sterility and low yield of fruit. Some intergeneric hybrids are highly sterile, other are quite fertile. Seedless varieties of navel orange fail to produce mature pollen and many seedy, diploid varieties have large proportions of bad pollen.

Intergeneric as well as interspecific hybrids can be produced, though the former type of cross seems more difficult. The hybrid vigour of the generative progeny seems to increase with the unlikeness of the parents, though crosses within the mandarin group (*C. nobilis* Lour.) have produced some very vigorous hybrids.

In the shaddock or pummelo (*C. grandis* Osbeck) nucellar embryony is absent and young seedlings seem to be comparatively uniform. Seedlings of polyembryonic forms, on the other hand, exhibit wide segregation, whether produced by selfing or crossing, and it appears that nucellar embryony has favoured the perpetuation of heterozygosis, whether the latter arises by hybridization or by mutation.

Genetic analysis is practically impossible with *Citrus*, but one or two characters, which are possibly due to simple recessive factors, are mentioned. Both somatic segregation and gene mutation are probably concerned in the production of the numerous somatic variations observed in *Citrus*. Periclinal chimaeras also account for some of the bud sports. In connexion with somatic segregation, it is pointed out that nucellar embryony, by favouring the evolution of extreme heterozygosis, has been a dominant agency in establishing the remarkable variability, both somatic and generative, of *Citrus*.

E. B. Babcock. *Phylogeny in the light of genetics and cytology.* (*pp. 28–30*).

The author briefly reviews the importance for phylogeny of studies of chromosome numbers, chromosome morphology and of meiosis in hybrids.

A. F. Shull. *Adaptation in the light of genetics.* (*pp. 31–33*).

This discussion of adaptation from the genetical view-point deals with animal material, in particular with mimics.

C. B. Davenport. *Genetics of human inter-racial hybrids.* (*pp. 34–36*).

C. B. Bridges. *The future of genetics.* (*pp. 37–39*).

Dr Bridges outlines the topics on which genetical research may be expected to concentrate in the near future, but recognizes that the unexpected discoveries are of great importance.

575.11:519.24
575.116.1

MATHER, K.

The measurement of linkage in heredity. Methuen and Co., Ltd., London 1938 : 4s. 6d. Pp. ix + 132. 42 + IV tables.

The object of this little book, as described in the author's preface, is to bring to the notice of geneticists the refined statistical methods which have been developed in recent years and to provide the necessary instruction for their use. It is pointed out that the wide application of such methods in field experiments has been helped by the publication of articles and textbooks, and it is hoped to perform a similar service for genetics.

In the preliminary chapter we are introduced briefly but concisely to the genetical problems of monohybrid segregation and dihybrid segregation with and without linkage. The statistical concepts introduced in this chapter are the binomial distribution, χ^2, and the method of maximum likelihood. Chapter II deals with two-class segregations and describes the testing of deviations with the standard error and the use of χ^2 for testing deviations and heterogeneity. The third chapter, on planning experiments, explains how to calculate the size of family required to test certain simple hypotheses. Chapter IV deals with the detection of linkage, the method used being the analysis of χ^2 by orthogonal functions. The next chapter describes the use of the method of maximum likelihood in estimating linkage; the product formula method is also briefly described. Chapter VI is again on planning experiments, in this case to obtain the best estimates of linkage (Cf. "Plant Breeding Abstracts", Vol. VII, Abst. 1087). Chapter VII deals with combined estimation and testing heterogeneity, using the method of maximum likelihood. Chapter VIII deals with disturbed segregations and Chapters IX and X with human genetics. The final chapter gives a list of symbols and formulae and four tables are provided, including a table of normal deviates and a table of χ^2. A brief list of references and an index conclude the book.

A commendable feature is the provision and working out of numerical examples. The methods become rather involved, especially towards the end of the book, but the exposition is lucid, and the plant breeder, already familiar with statistical methods should find no great difficulty in understanding the book, which seems likely to perform a valuable service for genetics and geneticists by the provision of these precise methods of investigation.

575.116
576.354.46

LUDWIG, W.

Faktorenkoppelung und Faktorenaustausch bei normalem und aberrantem Chromosomenbestand. (**Linkage and crossing-over of factors in normal and aberrant chromosome complements**). Georg Thieme, Leipzig 1938 : RM.11† : Pp. 245. 74 figs. 15 tables.

The admirable series of monographs on problems of theoretical and applied genetics is continued by this useful work on linkage, a contribution to the theoretical side. The book is not a "popular" work and gives a thorough account dealing with every aspect of the problem. Though the emphasis is on the genetical side the cytological aspect is also described.

The first chapter gives a general, introductory account of the topics and the second describes the more straightforward genetics, covering such subjects as the conception of linkage,

number of linkage groups, measurement of linkage, linear order of the genes, chromosome mapping, coincidence and interference and the measurement of interference. The next chapter, relating the genetical results to the cytological gives cytogenetic proofs of the chromosome theory of inheritance, of the linear arrangement of genes and of crossing-over. The fourth chapter deals with the more abstruse genetical matter arising from four-strand crossing-over and the final chapter is again cytogenetical. This is perhaps the most interesting chapter, describing the influence of hereditary and environmental factors on linkage, crossing-over in structurally and numerically aberrant complements, the cytological basis of crossing over and, finally, in an appendix, somatic crossing-over and variegation, non-homologous crossing-over and interchromosomal linkage resulting from segmental interchange. The section on the cytological basis of crossing-over gives a brief account and some criticisms of Darlington's theories. The one-to-one correspondence of chiasmata and cross-overs is accepted, but other aspects of Darlington's work are subjected to criticisms which seem to be based, at least in part on an incomplete understanding. The book concludes with some errata and additions, an extensive bibliography and name and subject indexes.

Although one or two minor inaccuracies were noted here and there, the book can be recommended to those requiring more than a superficial knowledge of linkage phenomena. It is, of course, very largely based on *Drosophila* work. The author deserves commendation for his judicious use of cytological results in support and extension of the genetical work.

GOLDSCHMIDT, R. 575.17

Physiological genetics.

McGraw-Hill Publishing Co., Ltd., London 1938 : 24s. 0d. Pp. ix + 375. 54 figs. 22 tables.

That branch of genetics which, linking up with physiology and embryology, concerns itself with the action of genes, though highly interesting and important is probably the least exhaustively studied part of the rapidly developing science of heredity. The amount of material in Professor Goldschmidt's thorough treatise shews, however, that our ignorance of this subject is not as complete as is often assumed and the hope expressed in his preface, that the book may form "the skeleton of a future science of physiological genetics" may well be justified.

The book is divided into four parts, the first of which is a brief introduction. The second and main part is entitled "the mutated gene and the potentialities of development." In this section the experimental facts relating to the action of genes are reviewed, special attention being given to the author's work on *Lymantria* and on the vestigial series in *Drosophila* and the work of others on colour inheritance in rodents, the Bar series in *Drosophila* and flower pigments. The generalization which emerges is the now well-known concept of genes as affecting rates. Part III is concerned with the cytoplasm and the activation of the gene, the cytoplasm being pictured simply as a background or matrix in which the genes work and not in itself determining any hereditary characters; plastid inheritance in plants is considered a special case. The last part discusses the nature of the gene and after introducing the concept of the gene as a part of a higher unit the author brings out the blunt suggestion that there is no such thing as a gene, mutation being a change in the structure of the chromosome, which is considered to be a molecular aggregate.

Dealing with a difficult and often very speculative subject, the book is not easy reading. The authority of the writer, a distinguished pioneer in this field, is a guarantee of accuracy and a recommendation. There is an extensive bibliography and an index.

DOBZHANSKY, T. 576.1:575

Genetics and the origin of species. Columbia University Press, New York 1937 : 18s. 0d. Pp. xvi + 364. 22 figs. 22 tables.

In view of their special interest in the genetical nature of organic diversity, plant breeders will consider the appearance of a book by such a distinguished authority as Professor Dobzhansky on genetics in relation to the origin of species an event of some importance.

The book is based on a series of lectures delivered at Columbia University in October, 1936,

and covers a wide range of topics. After an introductory chapter on organic diversity, an account of gene mutation is given, followed by a consideration of gene mutation as a basis for racial and specific differences. Chapter IV deals with chromosomal changes. The next two chapters are concerned with variation in natural populations and selection respectively, special attention being paid to the mathematical work on these problems, in particular that of S. Wright. Polyploidy is the subject of the next chapter and this is followed by chapters on isolating mechanisms and on hybrid sterility. The final chapter deals with species as natural units of classification.

A most commendable general feature of the book is that in a subject which gives so much scope for speculation and word-spinning, the author confines himself to facts. This combines with the very high standard of accuracy and an orderly and clear exposition to produce a very satisfying book. Special features which may be selected to illustrate the value of the work are the treatment of the mathematical aspects and of the genetical and cytological analysis of natural populations of *Drosophila*. The mathematical material is expounded and related to observation in a way which should do much to widen the appreciation and practical value of this rather abstruse work. The analysis of natural populations of *Drosophila* has been greatly facilitated by the use of the giant salivary gland chromosomes and most of the work reported here is either recently published or unpublished. Indeed, the greater part of the work cited in the book is recent. The theme which runs through the work is the dynamic concept of evolution, leading to the definition of species as a stage in evolution, "at which the once actually or potentially interbreeding array of forms becomes segregated in two or more separate arrays which are physiologically incapable of interbreeding".

The book is provided with an extensive bibliography and an index and though misprints, some of them misleading, are rather frequent, the production is, in general, pleasing.

BERTALANFFY, L. VON 577

Das Gefüge des Lebens. (**The structure of life**). B. G. Teubner, Leipzig and Berlin 1937 : Bound RM.6.80† : Pp. iv + 197. 67 figs.

This book has been written in the hope of interesting a wide circle of readers in some of the outstanding modern problems and the results achieved in biological science.

Beginning with general principles, including a short historical survey, the structure of life throughout the scale of living organisms is considered. The idea of constancy amidst the changing of the parts is dealt with in the following chapter. Then follows a chapter on the course of life, one on the organism and the environment and, finally, one in which inheritance is discussed only as a biological problem.

There is a comprehensive bibliography and a useful glossary of technical terms beside the index.

BECK, C. 578.6

The microscope. Theory and practice. R. and J. Beck, Ltd., London 1938 : 7s. 6d. Pp. 264. 217 figs.

Published by the well-known microscope firm of R. & J. Beck, Ltd., this book gives a straightforward account of the principles and practice of microscopy, without going into too much detail on the theoretical side, being designed for the users of rather than the specialists in microscopes.

After a brief general account of the instrument, the geometric optics of the miscroscope are considered. An account is given of the problem of aperture and resolution, followed by a chapter on the photometry of the microscope and one on illumination and technique. Some typical and special microscopes are then described and the last two chapters deal with the testing of object-glasses and the use of polarized light. An index concludes the book.

Though the microscope is probably the most widely used instrument in biology it cannot be said to be the best understood. The book under review will be read with profit by those who feel that their use of the microscope would be improved by a better understanding of the principles involved.

NODARI, L.,
CALVINO, M. and
AVERNA-SACCÀ, R. 633.00.14(61.2)
Nuovi orizzonti agricoli della Libia. (**New agricultural prospects for Libya**). Istituto Fascista dell'Africa Italiana 1938 : 2nd ed. 45 lire. Pp. 414. 38 illus.

An account of the introduction of various tropical herbaceous and leguminous forage plants, starch plants, cereals, forest and fruit trees, industrial and medicinal plants and ornamental plants into the Italian colony of Libya in order to increase the production of that country. The plants were imported from Brazil and the results of six years cultivation in Libya are recorded.

SWANSON, C. O. 633.11:664.641.016
Wheat and flour quality. Burgess Publishing Company, Minneapolis, Minn. 1938 : $3.00. Pp. 227. 12 figs. 134 tables.

In this volume the author has incorporated the substance of his lectures on the factors involved in wheat and flour quality. The subject has, however, been extended in order to be of use to millers, bakers and other concerned with and interested in the quality of flour.
The range is therefore extensive, and the subject-matter is conveniently divided among twenty-six chapters, each with its own bibliography of relevant literature.

RAMIAH, K. 633.18(54.8)
Rice in Madras. A popular handbook.
The Superintendent, Government Press, Madras 1937 : Rs. 2. Pp. viii + 249. illus.

Although in the preface the author maintains that the work cannot be considered a text book, yet the amount of information herein collected makes it a valuable guide to anyone concerned with rice cultivation in India. Written in response to a demand for a non-technical book, it gives, in a simply written form a clear account of the many aspects of rice growing, including statistics, botany, genetics, cytology and diseases and pests, and a chapter on rice in the rest of India and other parts of the world. There is a good bibliography, useful appendices giving among others the strains already produced in Madras, explanations of the vernacular terms used and the common names of weeds and crop plants with their botanical names.

SENAY, P. 633.51
Le coton, sa production at sa distribution dans le monde. Tome I. (**Cotton, its production and distribution throughout the world. Volume I**). Lepouze, Le Havre 1937 : 40 fr. Pp. 229. 47 figs.

The whole subject of cotton is so vast and includes so many aspects, scientific, technical and economic, that a complete treatise by one man is hardly possible. The author, therefore, has limited the scope of his work to the raw material and its production. In the first volume there is a very short summary of the history and origin of the cotton plant and in Chapter II descriptions of the species of *Gossypium* of economic interest. Then follows a chapter on the physical characters of the fibres and their commercial classification. Chapter IV deals with some of the pests and diseases of the plant and the measures for protection, and the rest of the volume is devoted to the production of cotton in the U.S.A. and in the other countries of the American continent.
There is a bibliography with 189 titles.

633.6:030.8
KERSTEN, W. 664.1:030.8
German-English technological and commercial dictionary of the sugar industry, with English-German supplement. Librarian, Western Sugar Refinery, Foot of 23rd St., San Francisco, Calif., December 1936 : $3.00. Pp. 28.

This useful collection of nearly 3,000 words has been compiled from German technical journals on sugar with the object of enabling the English technologist with an adequate knowledge

of German, to read relevant German technical periodicals without having recourse to other dictionaries. Twenty-four pages are devoted to the German-English section and four to the English-German. No grammatical particulars (gender, plurals, etc.) are given—an omission which may be welcomed by the technical expert, who, if not a linguist, is seldom aware of the need for such information, until confronted by some obscurity that defeats his rule of thumb method of translation.

The photostat reproduction is clear and the arrangement of the words in two columns per page has resulted in a reference book of convenient size for the pocket.

Suggestions or additions for a future enlarged edition are invited; and the author is preparing similar French-English and Spanish-English dictionaries.

633.72:030.3

Vraagbaak voor theecultuur en theebereiding. (Samengesteld door het Proefstation West-Java). [**Compendium on tea cultivation and manufacture,—(Compiled by the West Java Experiment Station)**]. Buitenzorg 1937 : Pp. 145. illus.

In its second edition, which has long been awaited since the first edition went out of print, this compendium has been revised, enlarged and amended under the guidance of a committee of practical experts in the Dutch East Indies.

In its new form the publication not only contains information on the most varied aspects of tea cultivation and manufacture, but is also intended to form a link between the practical man and the experiment station and to promote co-operation between all parties engaged in the cultivation of tea.

The subject has been treated under the following headings: soils; cultivation; breeding; diseases and pests; preparation. An up-to-date and classified bibliography is also provided for those seeking further information, while the alphabetical subject index which completes the volume is supplemented by copious cross-references throughout the text. A further section planned, but ultimately not included in the text, deals with tea restriction regulations; it is to appear as a supplement issued by the Algemeen Landbouw Syndicaat.

As a comprehensive and compact assemblage of useful data this book should be extremely valuable to the planter or any one with a working knowledge of Dutch who requires practical information on the various processes involved in the cultivation and manufacture of tea. Finally, for translators or those wishing to consult the relevant scientific or technical literature of the subject, the book will serve as the necessary key to the highly specialized terminology that has grown up round the industry in the Dutch East Indies.

The volume is well printed, strongly bound and provided throughout with blank pages upon which notes can be made if necessary.

The book is not obtainable through publishers or booksellers.

633.855.34(92)
633.855.34:575(92)

Blommendaal, H. N.

De oliepalmcultuur in Nederlandsch-Indië. (**Oil palm cultivation in the Dutch East Indies**). H. D. Tjeenk Willink and Zoon N.V. Haarlem 1937 : Unbound fl. 3.25. Bound fl. 4. Pp. 190. 29 illus.

This useful and essentially practical handbook on oil palm, *Elaeis guineensis* Jacq., provides a good survey of cultural and industrial practices in the Dutch East Indies. Two chapters (15 pages) are devoted to the botanical description of the plant, its biology (including a brief note on artificial pollination) and selection and breeding. The remaining chapters deal with cultivation, diseases and pests, manufacture transport, sale uses and statistical data.

In considering oil palm-breeding the question of varieties and the percentage of shell present are recommended as the most practical basis for varietal classification. Where breeding is practised in the Dutch East Indies the aim is to obtain pure Tenera lines and also to isolate genetically high yielding Dura types by artificial cross and self-pollination. Attempts to obtain a constant Tenera type with high yield and fruit quality seem to indicate that these two characters are inversely related; but there is always the possibility that they may be combined by crossing pure Tenera types with selected Dura types.

The Deli (Dura) type is the most important in breeding experiments, which can in the first instance be directed to selecting to increase the total number of fruits or fruit clusters, and reducing the percentage of palms producing no flowers or solely male flowers.
Some good results as regards yield have already been obtained from seedlings from artificial crosses. Future work should take into consideration the number of clusters and oil content of the fruits. In selecting mother trees a high yield of fruit combined with a high average weight per cluster should be included in the criteria.

HOARE, A. H. and
TAYLOR, H. V. (foreword by) 634.11–1.5
Commercial apple growing. Martin Hopkinson, Ltd., London 1937 : 10s. 0d. Pp. 245. 15 figs.

For anyone contemplating the growing of apples on a commercial basis, this book, written from first-hand practical and scientific experience provides, probably for the first time, in one handy volume, a most valuable survey of the subject.
The position of the home industry is first considered, followed by an account of the varieties of apple for commercial cultivation and a few notes on the problems of sterility and cross-pollination. Then follow chapters on the cultivation of the apple and on marketing and storage of the crop. Two chapters are devoted to pests and diseases and one to finance and accounts.
In conclusion, the author has included a personal note, giving his own preferences if he were embarking himself on the enterprise of commercial apple growing.

PATEL, J. S. 634.61
The coconut. A monograph. Printed by the Superintendent, Government Press, Madras 1938 : 3 rupees 12 annas : Pp. vii + 313.

A monograph by the oil seeds specialist of the Madras Department of Agriculture, giving a general account of the crop and embodying the unpublished results of the research carried on by that department. After an introductory chapter the successive chapters deal with cultivation, the root, the stem, the leaf, floral biology, manuring and cultivation, yield, germination, with reference to the selection of seed nuts, the nuts, copra and oil, coconut products, tapping for juice, diseases and pests and, finally, abnormalities.
There is an appendix of fourteen tables, a bibliography and an index.
As a thorough account of an important oil seeds crop, the work should be useful to all interested in the coconut and in economic botany in general.

634.9:016
Forest bibliography to 31st December, 1933. Published by Dep. Forest, Univ. Oxford 1937 : Pt. II : 12s 6d. 79–199.

Part I of this publication has already been reviewed (Cf. "Plant Breeding Abstracts", Vol. VII, Abst. 475). The part under review continues the section on silviculture and covers natural reproduction, artificial reproduction, tending, silvicultural systems and notes on trees.

GRÜNWOLDT, F. 634.9:058
Internationales Adressbuch für Forstwirtschaft, Holzwirtschaft, Jagd und Naturschutz. Teil I: Internationales und Nordamerika. (**International index to forestry and allied organizations. Part I: International and North America**). J. Neumann, Neudamm and Berlin, 1938: Pp. 94. illus.

This work is intended to meet the long standing need for a reference book of addresses or organizations, etc., for those interested in forestry, the timber industry, sport and conservation: it has been compiled with the cooperation of Professor F. Heske (Editor of the "Zeitschrift für Weltforstwirtschaft"), the publishing firm of J. Neumann and various other workers in different parts of the world.
Part I, which has just been issued, indicates the general plan of the whole compilation, which should be invaluable when completed. Part I deals with International and North American organizations; Part II will cover Europe; Part III, Asia and Australia (including Oceania);

Part IV, Central and South America; Part V, Africa. In addition to these five geographical main groups, a subsidiary triple subject classification has been adopted under (*a*) State and Quasi Public Administrations; (*b*) Schools, Research Stations and other Institutions; (*c*) Associations, Professional Societies, etc.: and within these three groups the data are classed under: I, Forestry; II, Lumber industry; III, Game and IV, Protection of nature. A subject index is also appended for tracing specific addresses.

The main functions of the various organizations included in the directory are succinctly described in German, English and French and useful notes are given of the publications which they issue. Where necessary good use has been made of diagrams and maps in illustrating the interrelations of the various bodies concerned with forestry or allied subjects in a particular country, e.g., U.S.A.

Since it is intended later on to alter and supplement the directory and to publish new editions for the various continents, one might perhaps suggest that the subject index—which should necessarily form an extremely important part of the whole—should be either considerably elaborated to contain more than merely one of the numerous possible key words under which a subject might be sought, or else supplemented by adequate though brief cross references. The latter suggestion is offered as possibly a less expensive and almost equally effective alternative.

The author is to be congratulated on having undertaken a task of very considerable importance and value to scientific and technical institutions and workers and on the methods adopted in its execution.

ROUEST, L. and
GUERPEL, H. DE 635.655:575(44)

Le soja français et ses applications agricoles et industrielles. (**The French soya bean and its agricultural and industrial applications**). Imprimerie Typographique G. Langlois, Chateauroux 1936 : 20 fr. Pp. xxiii + 228. 22 figs.

This is a new and re-named edition of "Le soja et son lait végétal", published in 1921, and now out of print. In the preface the author stresses the importance of the soya bean as an economic plant, its uses, ranging from food for human consumption to the manufacture of explosives, and urges its cultivation in France.

The history of the cultivation of the soya bean in Europe is first considered, then the botanical characters of the plant and its varieties. A chapter is devoted to the selection of the soya bean and its cultivation is described. Most of the book is taken up with the various uses of soya bean products. There is a bibliography of forty-two titles, none later than 1919.

NEW JOURNAL.

Journal of Coconut Industries.

This new journal is published for the Ceylon Coconut Board and deals mainly with the commercial side of the coconut industry. In addition to statistics on the different branches of the Ceylon coconut industry it contains articles on different aspects. The information given should be of considerable interest to those concerned in the coconut trade. (Edited by A. Gnana Prakasam. Published by Elmer Brito for The Ceylon Coconut Board, Colombo. Issued every quarter, 50 cents.)

INDEX

Aamisepp, J., 1371
Achyutha Wariar, U., 1032
Åkerberg, E., 1368
Alam, N., 1025
Alderman, W. H., 1300, 1303
Allan, H. H., 1103
Ammal, E. K. Janaki, see Janaki Ammal, E. K.
Anderson, D. C., 1191
Anodin, P. S., 1167
Anonymous, 1003, 1004, 1023, 1040, 1045, 1050, 1059, 1060, 1062, 1080, 1090, 1176, 1243, 1252, 1256, 1267, 1268, 1328, 1348, p. 417, p. 418, p. 423, p. 424
Aragon, V. B., 1202
Arceneaux, G., 1259
Arutiunova, N., 1279
Arutjunova, see Arutiunova
Atkins, I. M., 1163, 1164
Avanzi, E., 1224
Averna-Saccà, R., p. 422
Ayyangar, G. N. Rangaswami, see Rangaswami Ayyangar, G. N.

Balch, R. T., 1257
Barbacki, S., 1122, 1137
Barmenkov, A., 1169
Barnes, H., 1077
Beachell, H. M., 1207
Beck, C., p. 421
Becker, H., 1165
Bees, H. B., 1030
Behrndt, G., 1349
Belcher, B. A., 1253
Bell, G. D. H., 1001, 1002
Benl, G., 1099
Bergström, I., 1312
Bertalanffy, L. von, p. 421
Bhatia, G. S., 1021, 1026
Bijhouwer, A. P. C., 1331
Bjerke, B., 1082, 1084
Blakeslee, A. F., 1009
Bliss, C. I., 1083
Blommendaal, H. N., p. 423
Bodkin, G. E., 1061
Bolsunov, I. I., 1270
Bondar, G., 1286
Breakwell, E. J., 1022
Bredemann, G., 1248, 1249
Breider, H., 1339
Bremer, A. H., 1120
Brown, H. B., 1086
Buchinski, see Bučinskii
Bučinskii, A. T., 1278
Bugaenko, N. I., 1277
Bunyard, E. A., 1075
Burt, B., 1043
Burtt Davy, J., 1058

Calidiore, E., 1324
Calma, V. C., 1255
Calvino, M., p. 422
Capó, B. G., 1085
Cayla, V., 1295
Chang, W. H., 1159
Chevalier, A., 1238, 1292, 1327
Christensen, J. J., 1165
Clark, J. H., 1334
Clayton, E. E., 1281
Colby, A. S., 1301
Cook, M. T., 1087
Coolhaas, C., 1269
Cooper, D. C., 1216
Corl, C. S., 1129
Cotton, J. R., 1242
Crane, H. L., 1325

Daniel, L., 1111
Darrow, G. M., 1336
Davy, J. B., see Burtt Davy, J.
Decker, R. E., 1186
Demaree, J. B., 1336
Deržavin, A. I., 1132
Deshpande, R. B., 1073
De Turk, E. E., 1192
Dillman, A. C., 1289
Dobzhansky, T., p. 420
Dolgušin, D. A., 1100
Domínguez, F. A. L., see López Domínguez, F. A.
Dorsey, M. J., 1299
Doughty, L. R., 1054

Edgar, J. L., 1016, 1017
Eigsti, O. J., 1116
Elmanov, S. I., 1275
Enikeev, see Yenikeyev
Ernst, A., 1106
Erwin, A. T., 1228, 1357
Evans, G., 1042
Evans, H., 1064
Evans, L. E., 1129
Evelyn, S. H., 1048

Fagen, F. N., 1307
Ferwerda, F. P., 1283
Flovik, K., 1209
Forester, H. C., 1121
Fort, C. A., 1257
Foster, H. H., 1281
Frandsen, K. J., 1102
Funk, G., 1343

G. . . . . , S. M., 1069
Gates, R. R., 113
Generalov, G. F., 1214
Georgi, C. D. V., 1020
Gerlach, G., 1162
Geyer, H., 1233
Ghimpu, V., 1274
Ghose, R. L. M., 1049
Gibson, R. E., 1316
Gilbert, S. M., 1015
Ginneken, P. J. H. van, 1262
Gnadinger, C. B., 1129
Goidànich, G., 1347
Goldschmidt, R., p. 420
Goluš, B. M., 1374
Goulden, C. H., 1010
Govaert, R., 1293
Grünwoldt, F., p. 424
Guerpel, H. de, p. 425
Gustafsson, Å., 1195
Gutiérrez, M. E., 1335

H., 1089
Haan, E. de, 1262
Hackbarth, J., 1218
Hadfield, J. W., 1031
Haga, T., 1222
Håkansson, Å., 1251
Hall, C. J. J. van, 1068
Hall, W. J., 1076
Hammond, J. B., 1078
Hancock, H. A., 1052
Hansen, N. E., 1304
Hanumantha Rao, K., 1037
Hartley, C. P., 1188
Hayes, H. K., 1375
Hertzman, N., 1223
Heyn, A. N. J., 1114
Hoare, A. H., p. 424
Hoblyn, T. N., 1016
Hodgson, P. W., 1330
Hoener, I. R., 1192
Hoffmann, W., 1196
Holbert, J. R., 1194
Houk, W. G., 1284
Howard, H. W., 1041
Howard, W. L., 1092
Howlett, F. S., 1310
Hübner, R., 1212
Humphrey, D. M., 1259
Hutchinson, J. B., 1014, 1046, 1047, 1049
Hutton, E. M., 1022

Imai, Y., 1053, 1070, 1203
Inariyama, S., 1250
Isenbeck, K., 1197
Iyengar, N. Kesava, see Kesava Iyengar, N.

Jahn, A., 1318
Janaki Ammal, E. K., 1063
Jenkins, M. T., 1184
Jirásek, V., 1210
Jodon, N. E., 1206, 1207
Johnson, I. J., 1375
Johnson, T., 1018
Jones, E., 1254
Joshi, W. V., 1079
Journée, G., 1138

Kaczmarek, A., 1341
Kadam, B. S., 1074
Kalis, K. P., 1296
Kasahara, K., 1203
Kearney, T. H., 1244
Kersten, W., p. 422
Kesava Iyengar, N., 1051
Keuchenius, A. A. M. N., 1134
Khitrinskii, V. F., 1105
Kiesselbach, T. A., 1185
Kihara, H., 1149, 1174
Kikuta, K., 1265

Kisielev, D. A., 1199
Köhler, E., 1128, 1234, 1237
Kopel'kievskii, G. V., 1175
Kosmodemianski, V. N., 1280
Kostoff, D., 1027, 1028, 1109, 1279
Krantz, F. A., 1225, 1226
Kreibohm de la Vega, G. A., 1246
Kříženecký, J., 1094
Krüger, W., 1263
Kuckuck, H., 1196
Kulebjaev, V., 1241
Kulešov, N. N., 1146
Kulkarni, R. K., 1074
Kumar, L. S. S., 1079

L. . . . . , H. M., 1065
Lamm, R., 1231
Lamprecht, H., 1361, 1369
Lantz, H. L., 1302
Larose, E., 1138
Laurila, V., 1198
Lauritzen, J. I., 1257
Lawrence, W. J. C., 1005
Layton, D. V., 1354
Ledingham, G. F., 1155
Lehmann, H., 1236
Leplae, E., 1294
Levykh, P. M., 1280
Lewicki, S., 1137
Lewis, R. D., 1187
Liegeois, P., 1287
Lijftogt, G., 1305
Lock, G. W., 1055, 1056
Longley, A. E., 1189
López Domínguez, F. A., 1087
Lüdecke, H., 1263
Ludewig, W., p. 419
Ljubimova, V. F., 1152
Luthra, J. C., 1039
Lysenko, T. D., 1093

McCalla, A. G., 1029
Macindoe, S. L., 1024
McIntosh, A. E. S., 1062
Madsen-Mygdal, T., p. 416
Mahta, O. N., 1043
Malakhovskii, A., 1101
Maluk, A. K., 1073
Manns, T. F., 1315
Marston, A. R., 1186
Mason, T. G., 1042
Mather, K., p. 419
Medvedev, G. M., 1161
Mehta, T. R., 1033
Meister, G. K., 1093
Meister, N. G., 1154
Melander, Y., 1345
Melnikova, N. K., see Mel'nikova, P.
Mel'nikova, P., 1273
Méneret, G., 1172
Meunissier, A., 1095
Miczyński, K. (Jr.), 1137
Middleton, G. K., 1178
Mieczyński, T., 1088
Milan, A., 1148
Mills, W., 1126
Missura, M. T., 1276
Mohammad, A., 1071
Morinaga, T., 1204
Morse, W. J., 1365
Moss, E. G., 1266
Mudaliyar, C. Rajasekhara, see Rajasekhara Mudaliyar, C.
Muller, G., 1093
Multamäki, K., 1217
Murav'ev, see Muraviev
Muraviev, V. P., 1264
Murphy, D. M., 1364
Musiiko, A. S., 1190

Nakamura, M., 1320
Narayana, G. V., 1008
Neatby, K. W., 1029
Neelakantan, L., 1044
Neely, J. W., 1240
Negrul, A. M., 1337
Newton, M., 1018, 1019
Neyman, J., 1012
Nicholls, W. H., 1066
Nilsson-Ehle, H., 1311
Nodari, L., p. 422
Norton, H. W., 1362
Nuorvala, S., 1217

Odland, M. L., 1232
Oehler, E., 1153
Oehlkers, F., 1096
Okabe, S., 1229
Oláh, L. von, 1230
Opsomer, J. E., 1123, 1205
Osborn, W. M., 1201
Otero, J. I., 1087

Painter, R. H., 1201
Pal, B. P., 1025
Pančenko, see Panchenko
Panchenko, N., 1169
Panse, V. G., 1014
Parker, J. H., 1145, 1200, 1201
Parris, C. K., 1265
Patel, J. S., 1008, p. 424
Patel, S. M., 1074
Pearson, E. S., 1012
Pesola, V. A., 1143, 1173, 1367
Pierce, W. H., 1364
Pirovano, A., 1338, 1340
Pisarev, V., 1147
Pitman, E. J. G., 999
Pitt, D. T., 1317
Plaček, E. M., 1291
Platikanov, N., 1107
Pohjakallio, O., 1182, 1217
Pokrovskii, N. V., 1171
Pomeroy, C. S., 1329
Pope, O. A., 1245, 1247
Porter, D. R., 1356
Prest, R. L., 1077
Prutskova, M. S., 1140
Pudkov, A. N., 1141
Puškarev, I. I., 1235

Quisenberry, J. H., 1194
Quisenberry, K. S., 1135

Rademacher, B., 1179, 1180
Rajasekhara Mudaliyar, C., 1057
Ramanujam, S., 1034
Ramiah, K., 1037, p. 422
Rangaswami Ayyangar, G. N., 1032
Rao, K. Hanumantha, see Hanumantha Rao, K.
Rao, M. K. Subba, see Subba Rao, M. K.
Rao, M. Venkobu, see Venkobu Rao, M.
Raşmusson, J., 1372
Reddick, D., 1126
Reed, C. A., 1325
Reed, G. M., 1181
Reyes, G. M., 1208
Richey, F. D., 1091
Richharia, R. H., 1072
Roberts, E., 1194
Rohweder, H., 1112
Rosenthal, C., 1353
Rosinger, A. von P., 1097
Rosinger, K. E., 1097
Rouest, L., p. 425
Rubtsov, V., 1136
Ruggles Gates, R., see Gates, R. R.

Samoilov, I. G., 1261
Sansome, F. W., 1007
Sapehin, A. A., 1150
Sartorius, O., 1342
Sarvayya, Ch. V., 1081
Savič-Stroganova, I. G., 1142
Savitskii, M. S., 1119
Scheibe, A., 1290
Scheu, H., 1339
Schmidt, M., 1308
Schmöle, J. F., 1298
Schribaux, 1139
Schwartze, C. D., 1332, 1333
Scott, C. M., p. 417
Scott-Moncrieff, R., 1006
Seitz, D., 1350
Senay, P., p. 422
Sengbusch, R. v., 1219, 1220
Senn, H. A., 1221
Serin, 1139
Sethi, B., 1033, 1035
Sethi, R. L., 1033
Shaw, J. K., 1309
Sherbakoff, C. D., 1144
Sherwood, S. F., 1253
Sie, H. T., 1125
Sievers, A. F., 1130
Sikka, S. M., 1071
Sinisalo, J., 1158
Sipkes, C., 1344
Sirks, M. J., 1108, 1360
Słaboński, A., 1137
Smith, D. C., 1177
Smith, G. S., 1157
Smith, H. B., 1362
Smith, H. F., 1011
Smith, H. H., 1281
Smith, J. M., 1031
Snelling, R. O., 1201
Sokolovskaya, A. P., 1211
Sousa Bourdouil, C., 1370
Sprague, H. B., 1183
Stakman, E. C., 1165
Stanton, T. R., 1181
Stebbins, G. L., 1115
Stoffels, E., 1285
Strelkova, O., 1213
Stringfield, G. H., 1187

Student, 1012
Stuivenberg, J. H. M. van, 1305
Subba Rao, M. K., 1067
Surmann, M., 1260
Sustrina, V. E., 1171
Svensson, V., 1352
Swanson, C. O., p. 422

Tammes, P. M. L., 1326
Tanaka, T., 1319, 1321, 1323
Tanaka, Y., 1313
Tang, C. H., 1159
Taylor, H. V., p. 424
Teik, G. L., 1020
Temple, C. E., 1351
Ternovski, M. F., 1271, 1272, 1276
Ternovskii, see Ternovski
Ternovsky, see Ternovski
Thompson, W. P., 1155
Timofeeva-Tjulina, M., 1160
Ting, Y., 1125
Tippett, L. H. C., p. 416
Tolaas, A. G., 1226, 1227
Tollenaar, D., 1297
Townsend, G. R., 1363
Tschulok, S., p. 417
Turesson, G., 1118
Tzitzin, N. V., 1156

Ueno, T., 1258
Ullmann, W., 1215
Uphof, J. C. T., 1322
Utter, L. G., 1127

Vakhrušev, E. T., 1104
Vavilov, N. I., 1093
Venkoba Rao, M., 1051
Vijayaraghavan, C., 1051
Vik, K., 1166
Vohl, G. J., 1168
Voss, J., 1131
Vries, O. de, 1124

Walker, R. I., 1117, 1346
Wang, C. M., 1159
Ware, J. O., 1239, 1245
Wariar, U. Achyutha, see Achyutha Wariar, U.
Waugh, A. E., p. 416
Weetman, L. M., 1355
Weickmann, G., 1170
Welch, B. L., 1000
Wellensiek, S. J., 1282
Wellhausen, E. J., 1133, 1193
Went, F. W., 1373
Whitney, L. D., 1265
Wilczyński, J., 1098
Williams, L. F., 1366
Williams, R. D., 1038
Williamson, J. A., 1036
Wimmer, G., 1263
Winkler, H., 1110
Wipf, L., 1216
Wishart, J., 1013
Wood, M. N., 1325
Woodcock, J. W., 1031
Woodworth, C. M., 1366

Yamashita, Y., 1151
Yamazaki, M., 1258
Yasui, K., 1288
Yeager, A. F., 1306, 1358
Yenikeyev, K. K., 1314

PUBLICATIONS OF THE IMPERIAL BUREAU OF PLANT BREEDING AND GENETICS

Plant Breeding Abstracts, issued quarterly, annual subscription 25/- (Great Britain and the other countries of the British Commonwealth of Nations 20/-). Single copies 7/6.

INDEXES	s.	d.
Subject Index to Vols. I to V of Plant Breeding Abstracts	5	0
Subject Index to Vols. VI and VII of Plant Breeding Abstracts	2	6

SUPPLEMENTS TO PLANT BREEDING ABSTRACTS	s.	d.
Summary of Reports received from Countries exclusive of the British Empire, 1928–31. Supplement I	2	6
Summary of Reports received from Stations in the British Empire 1932–35. Supplement II	2	6

TECHNICAL COMMUNICATIONS	s.	d.
Plant Breeding in the Soviet Union. (Joint Publication of the Imperial Bureaux of Plant Genetics)	–	–*
Vernalization or Lyssenko's Method for the Pre-treatment of Seed	–	–*
Vernalization and Phasic Development of Plants	10	0

BIBLIOGRAPHICAL MONOGRAPHS	s.	d.
Wheat Breeding Bibliography Part I	–	–*
,, ,, ,, Part II	–	–*
Breeding Varieties Resistant to Disease	–	–*
Breeding Resistant Varieties, 1930–33 (Supplement)	2	0
Lodging in Cereals		6
Oat Breeding Bibliography	1	6
Rice Breeding Bibliography	1	6
Bibliography on Interspecific and Intergeneric Hybridization in Relation to Plant Breeding	2	0
Account of the Research in Progress in the British Empire	3	6
Rye Breeding Bibliography	1	6
Barley Breeding Bibliography	–	–*
Bibliography on Breeding Sorghums and Millets	1	0
Bibliography of Baking Quality Tests	2	6
The Experimental Production of Haploids and Polyploids	5	0
The South American Potatoes and their Breeding Value	3	6
An Outline of Cytological Technique for Plant Breeders	1	6
Tobacco Breeding Bibliography	1	0

* Publications thus marked are out of print.

IMPERIAL AGRICULTURAL BUREAUX

EXECUTIVE COUNCIL.
2, Queen Anne's Gate Buildings, London, S.W.1.

IMPERIAL BUREAU OF SOIL SCIENCE.
Rothamsted Experimental Station, Harpenden, Herts.

IMPERIAL BUREAU OF ANIMAL NUTRITION.
The Reid Library, Rowett Institute, Bucksburn, Aberdeen.

IMPERIAL BUREAU OF ANIMAL HEALTH.
Veterinary Laboratory, New Haw, Weybridge, Surrey.

IMPERIAL BUREAU OF ANIMAL BREEDING AND GENETICS.
King's Buildings, University of Edinburgh, Scotland.

IMPERIAL BUREAU OF PLANT BREEDING AND GENETICS.
School of Agriculture, Cambridge.

IMPERIAL BUREAU OF PASTURES AND FORAGE CROPS.
Agricultural Buildings, Alexandra Road, Aberystwyth.

IMPERIAL BUREAU OF HORTICULTURE AND PLANTATION CROPS.
East Malling Research Station, East Malling, Kent.

IMPERIAL BUREAU OF AGRICULTURAL PARASITOLOGY (HELMINTHOLOGY).
Winches Farm, Hatfield Row, St. Albans, Herts.

The Imperial Bureau of Plant Breeding and Genetics

Director: PROF. F. L. ENGLEDOW, M.A., Drapers' Professor of Agriculture.

Deputy Director: P. S. HUDSON, Ph.D.

Assistants:

MRS. R. M. INGHAM, M.Sc.
MISS M. L. C. WILSON, B.A.
J. L. FYFE, M.Sc.

Secretary: MISS K. M. STEARN.

IMPORTANT NOTE.—Every effort is made by the staff of the Imperial Bureau of Plant Genetics to make Plant Breeding Abstracts as complete as possible and to include all papers referring to plant breeding or the genetics of crop plants with the least possible delay after publication. In order to ensure this, authors are invited to send copies of their papers immediately on publication to the Deputy Director.

Plant Breeding Abstracts are issued quarterly at an inclusive price of 25/- per annum (Great Britain and the other countries of the British Commonwealth of Nations 20/-) single copies 7/6 each. Subscriptions or exchanges should be sent to the Deputy Director, Imperial Bureau of Plant Breeding and Genetics, School of Agriculture, Cambridge, England.

A few back numbers of Plant Breeding Abstracts are obtainable at 35/- per volume, single numbers 10/- each.

Other publications of the Bureau appear inside the back cover.

Loss in Transit.—It is only possible for the Bureau to meet claims for numbers of Plant Breeding Abstracts lost in transit when notice of the loss is received within three months of the date of posting.

PRINTED BY W. HEFFER & SONS LTD., CAMBRIDGE